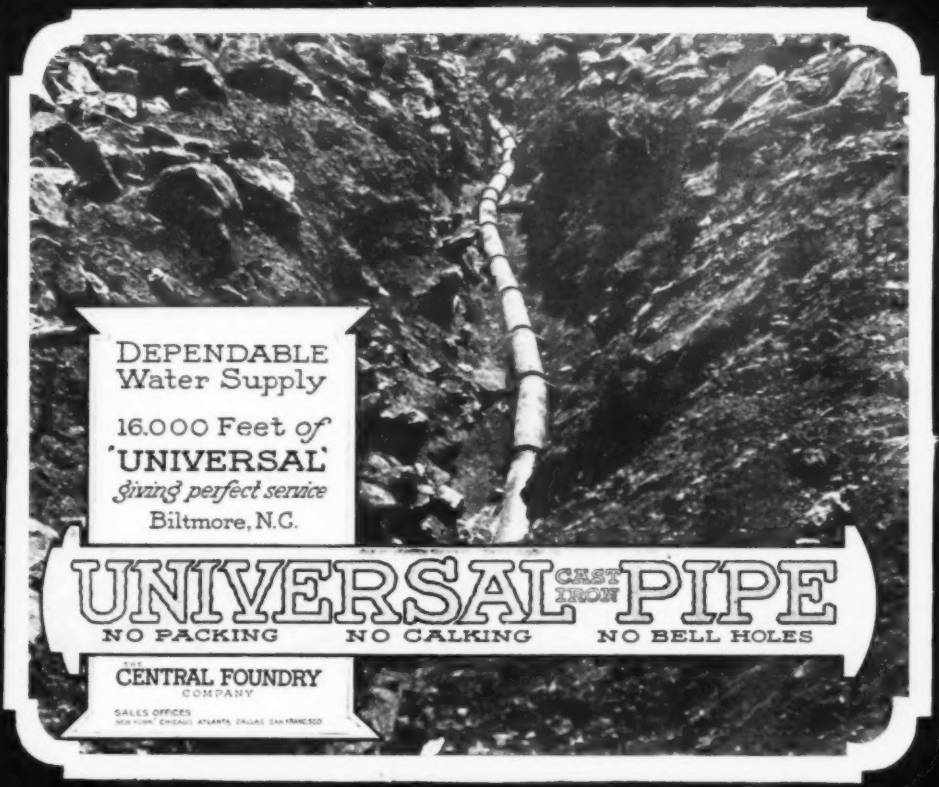
CONTRACTORS' & ENGINEERS' MONTHLY

A Purchasing Guide for Engineers, Contractors, Public Officials and Other Buyers of Construction Equipment.



OCTOBER 1921 — 25 Cents the Copy, One Dollar Yearly

The

SEARCHLIGHT SECTION

of

ENGINEERING NEWS-RECORD

(Circulation 30,000 Weekly)

"Searchlight" prints the largest variety of good used contractors' equipment for sale, rent or exchange to be found anywhere. It is the NATIONAL exchange center for such plant and for every other business want of contractors. Each week brings a new list of plant and new opportunities of all kinds for business—contracts wanted and to-be-let, financial, employment, etc., etc.

The
CONTRACTORS' GUIDE
for
SECOND-HAND EQUIPMENT
For Sale — For Rent
Exchange — Wanted
CONTRACTS TO-BE-LET
Government, Municipal & Private
BUSINESS OPPORTUNITIES
Work Wanted, Financial, Sub-Contracts, etc.
EXPERIENCED MEN
Available and Wanted

A Sample Copy — FREE

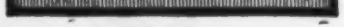
Be sure you see the Searchlight Section of Engineering News-Record regularly. Without obligation to you we would like to send you a copy of Engineering News-Record for your inspection. We want you to know how "Searchlight" is ready to serve you and how you can use it profitably.

Write at Once.

Searchlight Dept.—McGRAW-HILL CO., INC.—475 10th Ave., New York City

SEARCHLIGHT SECTIONS appear only in McGRAW-HILL publications—each the leader in its field.

Engineering and Mining Journal
Electric Railway Journal
Electric Merchandising
Journal of Electricity & Western Industry
Coal Age
Engineering News-Record
Chemical & Metallurgical Engineering
Power
American Machinist
Electric World
Ingeneria Internacional



Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers, water-works superintendents, municipal and county engineering departments, street and highway officials, city managers, etc., and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

ACETYLENE
Linde Air Products Co., New York.
Prest-O-Lite Co., Inc., New York.

ACETYLENE APPARATUS
Davis-Bournonville Co., Jersey City, N. J.
Oxweld Acetylene Co., Newark, N. J.

ADDING MACHINES. (See Calculating Machines.)

AIR COMPRESSORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Indiana Air Pump Co., Indianapolis, Ind.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Standard Scale & Supply Co., Pittsburgh, Pa.
Cement-Gun Co., Inc., Cornwell Hts., Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
De Laval Steam Turbine Co., Trenton, N. J.
De La Vergne Machine Co., N. Y. C.
Gardner Governor Co., Quincy, Ill.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., N. Y. C.
Mundie Mfg. Co., Peru, Ill.
Norwalk Iron Works Co., South Norwalk, Conn.
Schramm & Son, Inc., Chris. D., West Chester, Pa.
Stratton & Bragg Co., Petersburg, Va.
Sullivan Mchy. Co., Chicago, Ill.
United Iron Works, Kansas City, Mo.
Westinghouse Trac. Brake Co., Wilmerding, Pa.
Worthington Pump & Mchy. Corp., N. Y. C.

ARC LAMPS
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ARCHITECTURAL IRON WORK
Chesapeake Iron Works, Baltimore, Md.
Dietrich Bros., Baltimore, Md.
Hirsch Rolling Mill Co., St. Louis, Mo.
Snead Arch Iron Works, Louisville, Ky.
Stewart Iron Works Co., Cincinnati, Ohio

ARMORED CONCRETE PAVEMENTS
*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., New York.

ARTESIAN WELL DRILLS AND PUMPS
*Am. Well Works, Aurora, Ill.

ASBESTOS, ETC.
*Carey Co., Philip, Cincinnati, Ohio.
Dominion Asbestos & Rubber Corp., N. Y. C.
Keasbey & Mattison Co., Ambler, Pa.

ASH HANDLING MACHINERY
*Otterson Auto Eductor Co., Springfield, O.
*Bay City Dredge Wks., Bay City, Mich.
*Byers Mach. Co., Ravenna, Ohio.
*International Motor Co., New York.
*Weller Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland O.
Brown Hoisting Mach. Co., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Green Eng. Co., East Chicago, Ind.
Guarantee Constr. Co., N. Y. C.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, Ohio.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Eng. Co., Cleveland, O.
Link Belt Co., Chicago, Ill.
Portable Mchy. Co., Passaic, N. J.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.

ASPHALT
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. of Ind., Chicago, Ill.
*Warren Bros. Co., Boston, Mass.
Atlantic Refining Co., Philadelphia, Pa.
Gulf Refining Co., Pittsburgh, Pa.
Headley Good Roads Co., Philadelphia, Pa.
New Orleans Refining Co., New Orleans, La.
Sinclair Ref. Co., Chicago, Ill.
Standard Oil Co. of Calif., San Francisco, Cal.
Standard Oil Co. of La., New Orleans, La.
Standard Oil Co. of N. J., Newark, N. J.
Standard Oil Co. of N. Y., New York.
Texas Co., N. Y. C.
U. S. Asphalt Refining Co., New York.

ASPHALT BLOCK
Hastings Pavement Co., New York.

ASPHALT CUTTERS
Dayton Pneumatic Tool Co., Dayton, Ohio.
Chicago Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

ASPHALT PLANTS, TOOLS, ETC.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Connery & Co., Philadelphia, Pa.
*Warren Bros. Co., Boston, Mass.
Austin Machinery Corp'n, Chicago, Ill.
Conklin & Harrington, Inc., New York, N. Y.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, Ohio.
Hetherington & Berner, Indianapolis, Ind.

ASPHALT ROLLERS. (See Road and Paving Rollers.)

ASPHALT SURFACE HEATERS
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Equitable Asphalt Maint. Co., Kansas City, Mo.
Hauck Mfg. Co., Brooklyn, N. Y.

BACKFILLERS
*Koehring Co., Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Weller Mfg. Co., Chicago, Ill.
American Cement Mchy. Co., Inc., Keokuk, Ia.
Austin Machinery Corp'n, Chicago, Ill.
Constr. Mchy. Co., Waterloo, Ia.
Oshkosh Mfg. Co., Oshkosh, Wis.
Parsons Co., Newton, Ia.

BAR BENDERS AND CUTTERS
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Machinery Co., Dunellen, N. J.
Concrete Steel Co., New York.
Electric Welding Co., Pittsburgh, Pa.
Hinman & Co., D. A., Sandwich, Ill.

BAR CHAIRS, REINFORCING
*Truscon Steel Co., Youngstown, Ohio.
Concrete Steel Co., N. Y. C.
Universal Form Clamp Co., Chicago, Ill.

BARS, IRON AND STEEL
Aborn Steel Co., Inc., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Carbon Steel Co., Pittsburgh, Pa.

Half Round Culverts

If you want to be more than 99 per cent sure that the culverts you have installed under your city streets or county highways will last indefinitely, install a NEWPORT CULVERT, made of "GENUINE OPEN HEARTH IRON", guaranteed to be 99.875 per cent pure iron-copper alloy.

NEWPORT CULVERTS are made in both round and half-round types of construction. The half—round type is particularly adapted to city and small town use, while the circular culvert is universally used for county highway work. The advantage of using the half-round culvert lies in its being particularly well adapted where the head room is not sufficient to install the full circle type of pipe, and in the further advantage of being able to clean it readily at any point in the event some obstruction causes the stoppage of same, which is frequently the case in city or small town use.

Send for booklets giving complete data on NEWPORT CULVERTS of "GENUINE OPEN HEARTH IRON"

NEWPORT CULVERT Co

542 WEST 10TH STREET NEWPORT, KENTUCKY

Carnegie Steel Co., Pittsburgh, Pa.
Franklin Steel Works, Franklin, Pa.
Gulf States Steel Co., Birmingham, Ala.
Hirsch Rolling Mill Co., St. Louis, Mo.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Midvale Steel & Ordnance Co., Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
St. Louis Screw Co., St. Louis, Mo.
Sweet's Steel Co., Williamsport, Pa.

BELTING, RUBBER
Allen Mfg. Co., W. D., Chicago, Ill.
Fairbanks Co., The, N. Y. C.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Goodyear Tire & Rubber Co., Akron, O.
McMaster-Carr Supply Co., Chicago, Ill.
Mulconroy Co., Inc., Philadelphia, Pa.
Republic Rubber Co., Youngstown, Ohio.
Salisbury & Co., Inc., W. H., Chicago, Ill.
Southern Rubber & Belt. Co., Houston, Tex.
Union Asbestos & Rubber Co., Chicago, Ill.
Voorhees Rubber Mfg. Co., Jersey City, N. J.

BENDING MACHINES (PIPE)
Amer. Pipe Bending Mach. Co., Boston, Mass.
Hinman Co., D. A., Sandwich, Ill.
Walworth Mfg. Co., Boston, Mass.

BINS, STORAGE
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Weller Mfg. Co., Chicago, Ill.
Atlas Eng. Co., Milwaukee, Wis.
Berger Mfg. Co., Canton, Ohio.
Galion Iron Works & Mfg. Co., Galion, Ohio.
Green Engineering Co., E. Chicago, Ind.
Petroleum Iron Works Co., Sharon, Pa.

BLAST HOLE DRILLING MACHINES. (See "Well Drilling and Blast Hole Machines")

BLASTING POWDER (See Explosives)

BLOCKS AND TACKLE
Boston & Lockport Block Co., East Boston, Mass.
Broderick & Bascom Rope Co., St. Louis, Mo.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Topping Bros., N. Y. C.
Upson-Walton Co., Cleveland, Ohio.

BLOWERS, PRESSURE
*General Electric Co., Schenectady, N. Y.
American Blower Co., Detroit, Mich.
American Gas Furnace Co., N. Y. C.
De Laval Steam Turbine Co., Trenton, N. J.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

BLUE PRINT MACHINES
Wickes Bros., Saginaw, Mich.

BLUE PRINT AND TRACING PAPERS
Indianapolis Blue Print & S'ply Co., Ind'apolis.
Kolesch & Co., New York.

BOILERS
Abendroth & Root Mfg. Co., Newburgh, N. Y.
Ames Iron Works, Oswego, N. Y.
Babcock & Wilcox Co., N. Y. C.
Biggs Boiler Wks., Akron, Ohio.
Casey-Hedges Co., Chattanooga, Tenn.
Chandler & Taylor Co., Indianapolis, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Cole Mfg. Co., R. D., Newnan, Ga.
Erie City Iron Works, Erie, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Hartley Boiler Works, Montgomery, Ala.
Heine Safety Boiler Co., St. Louis, Mo.
Houston, Stanwood & Gamble Co., Cincinnati, O.
Industrial Works, Bay City, Mich.
Ladd Co., Geo. T., Pittsburgh, Pa.
Leffel & Co., J., Springfield, O.
Lord & Burnham Co., Irvington, N. Y.
Murray Iron Works Co., Burlington, Ia.
New Bern Iron Wks. & Sup. Co., New Bern, N. C.
Petroleum Iron Works Co., Sharon, Pa.
Randle Mchy. Co., Cincinnati, O.
Schofield Iron Works, Macon, Ga.
Traylor Engr. & Mfg. Co., Allentown, Pa.
Valk & Murdoch Co., Charleston, S. C.
Vogt Mchy. Co., Inc., Louisville, Ky.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

BOLTS, NUTS, NAILS, RIVETS, SPIKES
American Screw Co., Providence, R. I.
American Spike Co., N. Y. C.
Ames, W. & Co., Jersey City, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., Buffalo, N. Y.
Clark Bros. Bolt Co., Milldale, Conn.
Erie Bolt & Nut Co., Erie, Pa.
Foster Bolt & Nut Mfg. Co., Cleveland, Ohio.
Inland Steel Co., Chicago, Ill.
Lamson & Sessions Co., Cleveland, Ohio.
Maryland Bolt & Forge Co., Baltimore, Md.
Milton Mfg. Co., Milton, Pa.
Neely Nut & Bolt Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Pittsburgh Screw & Bolt Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Rhode Island Tool Co., Providence, R. I.
Russell, Burndall & Ward Co., Port Chester, N. Y.
St. Louis Screw Co., St. Louis, Mo.
Scranton Bolt & Nut Co., Scranton, Pa.
Star Exp. Bolt Co., N. Y. C.
Sweet's Steel Co., Williamsport, Pa.

BRACES, TRENCH
*Duff Mfg. Co., Pittsburgh, Pa.
*Waldo Bros. & Bond Co., Boston, Mass.

BRASS GOODS
*Hays Mfg. Co., Erie, Pa.
*Mueller Mfg. Co., H., Decatur, Ill.
*Union Water Meter Co., Worcester, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.
United Brass Mfg. Co., Cleveland, O.

BRICK, PAVING (See Paving Brick)

BRIDGES AND BUILDINGS, STEEL
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
*Snare Corp., Frederick, New York, N. Y.
American Bridge Co., N. Y. C.
Bellefontaine Bridge & Steel Co., Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Berlin Constr. Co., Berlin, Conn.
Bethlehem Steel Bridge Corp., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Boston Bridge Works, Boston, Mass.
Central States Bridge Co., Indianapolis, Ind.
Champion Bridge Co., Wilmington, O.
Chesapeake Iron Works, Baltimore, Md.
Chicago Bridge & Iron Works, Chicago, Ill.
Clinton Bridge Wks., Clinton, Iowa.
Eastern Bridge & Struc. Co., Worcester, Mass.
Ferguson Co., H. K., Cleveland, O.
Flour City Orn. Iron Co., Minneapolis, Minn.
Fort Pitt Bridge Works, Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Ingalls Iron Works Co., Birmingham, Ala.
Inland Steel Co., Chicago, Ill.
Inter. Steel & Iron Co., Evansville, Ind.
King Bridge Co., Cleveland, O.
Lackawanna Bridge Co., Buffalo, N. Y.
Lewis-Hall Iron Wks., Detroit, Mich.
Louisville Bridge & Iron Co., Louisville, Ky.
McClintic Marshall Co., Pittsburgh, Pa.
Milwaukee Bridge Co., Milwaukee, Wis.
Minn. Steel & Mchy. Co., Minneapolis, Minn.
Missouri Vy. Bdge. & Iron Co., Leavenworth, Kan
Morava Constr. Co., Chicago, Ill.
Mt. Vernon Bridge Co., Mt. Vernon, Ohio.
Penn. Bridge Co., Beaver Falls, Pa.
Richmond Struc. Steel Co., Richmond, Va.
Riverside Bridge Co., Martins Ferry, O.
Toledo Crane Co., Toledo, O.
Virginia Bridge & Iron Co., Roanoke, Va.
Wisc. Bridge & Iron Co., North Milwaukee, Wis.

BUCKETS, AUTOMATIC DUMPING
*Littleford Bros., Cincinnati, O
*Weller Mfg. Co., Chicago, Ill.
Lakewood Engineering Co., Cleveland, O.
Stuebner Iron Works, G. L., Long Island City, N. Y.

BUCKETS, CLAM SHELL
*Owen Bucket Co., Cleveland, O.
Advance Eng. Co., Cleveland, O.
Austin Mach. Corp., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Brosius, E. E., Pittsburgh, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Byers Mach. Co., J. P., Ravenna, O.
Haiss Mfg. Co., Geo., N. Y. C.
Hayward Co., N. Y. C.
Industrial Works, Bay City, Mich.
Kiesler Co., J. F., Chicago, Ill.
Lakewood Engineering Co., Cleveland, O.

OWEN Clam Shell BUCKETS INSURE A BIGGER DAYS WORK
The Speed Bucket
for economical handling of crushed stone and other building materials from cars. The Type "O" Owen Bucket takes off the top of the load in less trips and cleans up the bottom in "jig" time.
THE ONLY BUCKET WITH LUBRICATED AND GRIT-PROOF MAIN BEARINGS. This and other features are big repair savers. Get complete data today.
The Owen Bucket Co.
418 Kirby Bldg., Cleveland, O.
OWEN

IDEAL EXPANSION JOINT

The Ideal Method of Providing for Expansion in Improved Pavements

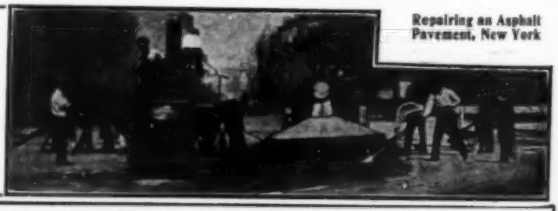
THE WARING-UNDERWOOD CO. FERNWOOD, PA.

Repair Your Streets with
THE LUTZ SURFACE HEATER

It softens asphalt and other bituminous pavements. It vulcanizes the old and new material into a perfect bond. It cements Asphalt on Granite, Brick, Cobbles, or other hard pavements. It makes re-surfacing and maintenance easy and inexpensive

Illustrated Particulars on Request

Equitable Asphalt Maintenance Co.
1901 Campbell St. Kansas City, Mo.



Repairing an Asphalt Pavement, New York

Where Quality Counts You Will Always Find The Famous

ACME ROAD BUILDING MACHINERY

LINE FOR EVERY PURPOSE

SEND FOR OUR DESCRIPTIVE MATTER

ACME ROAD MACHINERY COMPANY, FRANKFORT, N. Y.

Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Williams Co., G. H., Erie, Pa.

BUCKETS, CONCRETE
*Koppel Ind. Car & Equip. Co., Koppel, Pa.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Rochester Can Co., Rochester, N. Y.
*Weller Mfg. Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.
Smith Co., T. L., Milwaukee, Wis.
Union Iron Works, Inc., Hoboken, N. J.

BUCKETS, DRAGLINE
*Bucyrus Co., So. Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Brown Hoisting Mach. Co., Cleveland, O.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., N. Y. C.
Industrial Works, Bay City, Mich.
Monighan Machine Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

BUCKETS, DREDGING AND EXCAVATING
*Bucyrus Co., So. Milwaukee, Wis.
*Owen Bucket Co., Cleveland, O.
Austin Machinery Corp'n, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Brown Hoisting Mach. Co., Cleveland, O.
Browning Co., Cleveland, O.
Hayward Co., N. Y. C.
Insley Mfg. Co., Indianapolis, Ind.
Kiesler Co., J. F., Chicago, Ill.
Lakewood Eng. Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.
Monighan Machine Co., Chicago, Ill.
Union Iron Works, Inc., Hoboken, N. J.
Williams Co., G. H., Erie, Pa.

BUCKETS, ORANGE PEEL
Haiss Mfg. Co., Geo., N. Y. C.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Kiesler Co., J. F., Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Mead-Morrison Mfg. Co., East Boston, Mass.
Orton & Steinbrenner Co., Chicago, Ill.
Vulcan Iron Works, Jersey City, N. J.

BUILDINGS, STEEL (See Bridges and Buildings)

BUNKS AND COTS
Fort Pitt Bedding Co., Pittsburgh, Pa.
Haggard & Marcusson Co., Chicago, Ill.
Southern Rome Co., Baltimore, Md.

CABLES (See Wire and Cables)

CABLEWAYS
Broderick & Bascom Rope Co., St. Louis, Mo.
Flory Mfg. Co., S., Bangor, Pa.
Lidgerwood Manufacturing Co., New York.
Roebling Sons Co., J. A., Trenton, N. J.
Sauerman Bros., Chicago, Ill.
Waterbury Co., N. Y. C.

CAISSONS
American Bridge Co., N. Y. C.
Foundation Co., N. Y. C.
Lackawanna Steel Co., Buffalo, N. Y.
O'Rourke Eng. Constr. Co., N. Y. C.
Petroleum Iron Works Co., Sharon, Pa.

CALCULATING MACHINES
*Monroe Calculating Machine Co., Orange, N. J.
Burroughs Adding Machine Co., Detroit, Mich.
Felt & Tarrant, Chicago, Ill.
Marchant Calc. Machine Co., Oakland, Cal.

CANS FOR GARBAGE AND STREET REFUSE
*Littleford Bros., Cincinnati, O.
*Rochester Can Co., Rochester, N. Y.
American Can Co., New York.
Butler Mfg. Co., Minneapolis, Minn.
Safety Sanitary Rubbish Box Co., Columbus, O.
Steel Basket Co., Cedar Rapids, Iowa.

CARS, INDUSTRIAL V. DUMPING
*Easton Car & Const'n Co., New York
*Koppel Ind. Car & Eq. Co., Koppel, Pa.
*Weller Mfg. Co., Chicago, Ill.
Atlas Car & Mfg. Co., Cleveland, O.
Austin Machinery Corp'n, Chicago, Ill.
Chase Fdry. & Mfg. Co., Columbus, O.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Oliver Mfg. Co., W. J., Knoxville, Tenn.
Stuebner Iron Works, G. L., Long Island City, N. Y.
United Iron Works, Kansas City, Mo.
Whiting Corp'n, Harvey, Ill.

CARTS, CONCRETE
*Gray Iron Fdry. Co., Reading, Pa.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Smith Co., T. L., Milwaukee, Wis.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Toledo Wheelbarrow Co., Toledo, Ohio.

CAST IRON PIPE (See Pipe, Cast Iron)

CASTINGS, IRON AND STEEL
*Central Fdry. Co., N. Y. C.
*Gray Iron Fdry. Co., Reading, Pa.
*Lynchburg Fdry. Co., Lynchburg, Va.
*Warren Fdry. & Mach. Co., N. Y. C.
American Cast Iron Pipe Co., Birmingham, Ala.
Camden Iron Works, Camden, N. J.
Canton Fdry. & Mach. Co., Canton, Ohio.
Clark Co., H. W., Mattoon, Ill.
Flower Valve Mfg. Co., Detroit, Mich.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Jeffrey Mfg. Co., Columbus, O.
Marion Malleable Iron Works, Marion, Ind.
Pechstein Iron Works, Keokuk, Iowa.
Sessions Fdry. Co., Bristol, Conn.
Speidel, J. G., Reading, Pa.
U. S. Cast Iron Pipe & Fdry. Co., Burlington, N.J.

CASTINGS, STREET AND SEWER
*Central Fdry. Co., N. Y. C.
*Lynchburg Fdry. Co., Lynchburg, Va.
Casey-Hedges Co., Chattanooga, Tenn.
Clow & Sons, J. B., Chicago, Ill.
Dee Co., W. E., Chicago, Ill.
Pechstein Iron Works, Keokuk, Ia.
U. S. Cast Iron Pipe & Fdry. Co., Burlington, N.J.

CATCH BASINS AND MANHOLE COVERS
*Thompson-Fleming Co., Inc., Buffalo, N. Y.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
Canton Fdry. & Mach. Co., Canton, Ohio.
Casey-Hedges Co., Chattanooga, Tenn.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Dee Co., W. E., Chicago, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Foundry Mfg. Co., St. Albans, Vt.
Madison Fdry Co., Cleveland, O.
Pechstein Iron Works, Keokuk, Iowa.
Sessions Fdry. Co., Bristol, Conn.

CATCH BASIN CLEANING APPARATUS
*International Motor Co., New York.
*Otterson Auto Eductor Co., Springfield, O.

CAULKING MACHINERY
*Mueller Mfg. Co., H. Decatur, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., N. Y. C.

CAULKING MATERIALS
*United Lead Company, New York.
Leadite Co., Philadelphia, Pa.

CEMENT
Ætna Portland Cement Co., Detroit, Mich.
Allentown Portland Cement Co., Allentown, Pa.
Alpha Portland Cement Co., Easton, Pa.
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.
Atlas Portland Cement Co., New York.
Bath Portland Cement Co., Philadelphia, Pa.
Beaver Portland Cement Co., Portland, Ore.
Bessemer Limestone and Cement Co., Youngstown, O.
Bonner Portland Cement Co., Kansas City, Mo.
Canada Cement Co., Ltd., Montreal, Canada.
Cape Girardeau Portland ement Co., Cape Girardeau, Mo.
Castalia Portland Cement Co., Pittsburgh, Pa.
Clinchfield Portland Cement Corp., Kingsport, Tenn.
Colorado Portland Cement Co., Denver, Colo.
Continental Portland Cement Co., St. Louis, Mo.
Coplay Cement Manufacturing Co., Coplay, Pa.

KOEHRING

Washington Roads are KOEHRING Built

CONSISTENT performance, and not unusual and spectacular day-run records, expresses true mixer value.

In the state of Washington in 1920 four out of every five pavers used in road building were Koehrings. Study these figures:

Total yardage of concrete paving completed in state of Washington in 1920	2,706,738 square yards
Number of separate paving contracts in operation	73
NUMBER HANDLED WITH KOEHRING PAVERS	58
Number handled with all other machines	15

Authentic records show that Washington placed the greatest yardage per man in 1920 and at the lowest cost per square yard of any state in the Union.

And 58 of the 73 jobs making this record—79.45%—were Koehring equipped.

Let us emphasize it again—the Koehring Heavy Duty Paver is the paver of lowest cost per batch of concrete—the paver of absolute dependability.

KOEHRING COMPANY
MILWAUKEE, WIS.

Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampum, Pa.
Dewey Portland Cement Co., Kansas City, Mo.
Dexter Portland Cement Co., Nazareth, Pa.
Diamond Portland Cement Co., Cleveland, Ohio.
Dixie Portland Cement Co., Chattanooga, Tenn.
Edison Portland Cement Co., New York.
Fredonia Portland Cement Co., Fredonia, Kans.
Giant Portland Cement Co., Philadelphia, Pa.
Gilmore Portland Cement Corp., Gilmore City, Iowa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Golden State Portland Cement Co., Los Angeles, Cal.
Gulf States Portland Cement Co., Demopolis, Ala.
Hawkeye Portland Cement Co., Des Moines, Ia.
Helderberg Cement Co., Albany, N. Y.
Hercules Cement Corp., Philadelphia, Pa.
Indiana Portland Cement Co., Indianapolis, Ind.
International Portland Cement Co., Ltd., Spokane, Wash.
Knickerbocker Portland Cement Co., Inc., New York.
Kosmos Portland Cement Co., Louisville, Ky.
Lawrence Portl'd Cement Co., Northampton, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monarch Cement Co., Humboldt, Kans.
Nazareth Cement Co., Nazareth, Pa.
Newaygo Portland Cement Co., Newaygo, Mich.
Nebraska Cement Co., Denver, Colo.
New Egyptian Portland Cement Co., Fenton, Mich.
New York & New England Cement & Lime Co., New York.
Northwestern States Portland Cement Co., Mason City, Ia.
Ogden Portland Cement Co., Ogden, Utah.
Oklahoma Portland Cement Co., Denver, Colo.
Old Mission Portland Cement Co., San Francisco, Cal.
Olympic Portl'd Cement Co., Ltd., Seattle, Wash.
Oregon Portland Cement Co., Portland, Ore.
Pacific Portland Cement Co., San Francisco, Cal.
Peerless Portland Cement Co., Union City, Mich.
Peninsular Portland Cement Co., Cement City, Mich.
Penn-Allen Cement Co., Allentown, Pa.
Penna. Cement Co., New York.
Petoskey Portland Cement Co., Petoskey, Mich.
Phœnix Portland Cement Co., Nazareth, Pa.
Portland Cement Co. of Utah, Salt Lake City, Utah.
Pyramid Portland Cement Co., Des Moines, Ia.
Riverside Portl'd Cement Co., Los Angeles, Cal.
San Antonio Portland Cement Co., San Antonio, Tex.
Sandusky Cement Co., Cleveland, Ohio.
Santa Cruz Portland Cement Co., San Francisco, Cal.
Security Cement and Lime Co., Hagerstown, Md.
Signal Mountain Portland Cement Co., Chattanooga, Tenn.
Southern States Portland Cement Co., Rockport, Ga.
Southwest'n Portland Cement Co., El Paso, Tex.
Standard Portland Cement Corp., San Francisco, Calif.
Superior Portland Cement Co., Seattle, Wash.
Texas Portland Cement Co., Dallas, Tex.
Three Forks Portland Cement Co., Denver, Colo.
Tidewater Portland Cement Co., Baltimore, Md.
Trinity Portland Cement Co., Dallas, Tex.
Union Portland Cement Co., Ogden, Utah.
United States Potash Co., Los Angeles, Cal.
U. S. Portland Cement Co., Denver, Colo.
Universal Portland Cement Co., Chicago, Ill.
Vulcanite Portland Cement Co., Philadelphia, Pa.
Wabash Portland Cement Co., Detroit, Mich.
Wellston Iron Furnace Co., Jackson, Ohio.
Western States Portland Cement Co., Independence, Kans.
Whitehall Cement Mfg. Co., Philadelphia, Pa.
Wolverine Portl'd Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Detroit, Mich.

CEMENT INSPECTION (See Inspecting Laboratories)

CEMENT MAKING MACHINERY
***Allis-Chalmers Mfg. Co., Milwaukee, Wis.**
Austin Machinery Corp'n, Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

CHAINS
***Weller Mfg. Co., Chicago, Ill.**
American Chain Co., Inc., Bridgeport, Conn.
Columbus McKinnon Chain Co., Columbus, O.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.
U. S. Chain & Forge Co., Pittsburgh, Pa.

CHAINS, STEEL AND MALLEABLE
Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

CHECK VALVES
***Mueller Mfg. Co., H., Decatur, Ill.**
Columbian Iron Works, Chattanooga, Tenn.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.

CHEMICALS FOR WATER PURIFICATION
***Du Pont de Nemours & Co., E. I., Wilmington, Del.**
***Mathieson Alkali Works, Inc., N. Y. C.**
***Penna. Salt Mfg. Co., Philadelphia, Pa.**
Electro Bleaching Gas Co., New York.
General Chemical Co., New York.

CHIMNEYS, CONCRETE
Heine Chimney Co., Chicago, Ill.
Rust Engineering Co., Pittsburgh, Pa.
Weber Chimney Co., Chicago, Ill.

CHIMNEYS, RADIAL BRICK
***American Chimney Corp., New York City.**
Kellogg & Co., M. W., New York.
Rust Engineering Co., Pittsburgh, Pa.

CHIMNEYS, STEEL (See Stacks, Steel)

CHLORINATORS
***Wallace & Tiernan Co., Inc., Newark, N. J.**

CHLORINE, LIQUID (See Liquid Chlorine)

CHUTES, CONCRETE
***Ransome Concrete Machy. Co., Dunellen, N. J.**
Insley Mfg. Co. Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

CLIPS, WIRE ROPE
American Hoist & Derrick Co., St. Paul, Minn.
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Carpenter Co., Geo. B., Chicago, Ill.
Leschen & Sons Rope Co., A., St. Louis, Mo.
Marion Malleable Iron Works, Marion, Ind.
Mockbee & Co., C. M., Cincinnati, O.
Roebling Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.

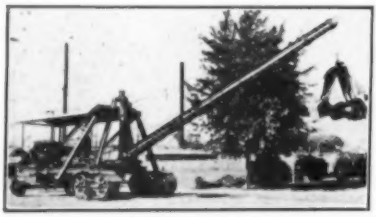
COAL AND ORE CONVEYING MACHINERY
***Bay City Dredge Works, Bay City, Mich.**
***Byers Machine Co., Ravenna, O.**
***Fairfield Engineering Co., Lancaster, Ohio.**
***Good Roads Mach'y Co., Philadelphia, Pa.**
***Weller Mfg. Co., Chicago, Ill.**
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Blaw-Knox Co., Pittsburgh, Pa.
Brown Hoisting Mchy. Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Hayward Co., New York.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York.
Webster Mfg. Co., Chicago, Ill.

COCKS, CURB AND CORPORATION
***Mueller Mfg. Co., H., Decatur, Ill.**
***Union Water Meter Co., Worcester, Mass.**
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Glauber Brass Mfg. Co., Cleveland, O.
Haydenville Co., Haydenville, Mass.

COLUMN CLAMPS
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
Universal Form Clamp Co., Chicago, Ill.

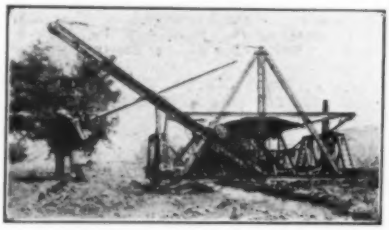
COMPRESSORS, AIR (See Air Compressors)

BAY CITY CRANES



For any material handling job.
Oil engine operated. Any type of traction.
All steel Boom. Clam Shell dipper or hook.
The most substantially built and lowest priced Motor Crane of this type, a *convertible* loader, digger or derrick.

WALKING DREDGES



For Drainage, Irrigation, Road or large tile ditches.
Capacities: ½ to 1 Cubic Yard.
Spans the ditch.
Self propelling over rough or swampy ground.

THE ONE MAN EXCAVATOR

For Clay, Sand, or Gravel Pits or Road Contractors. ⅜ cubic yard capacity.

Bay City Dredge Works
2622 Center Ave. Bay City, Mich.

The Jack for All Trades

Never Turns Around
Never Backs Down

The Doughboy Jack

—the lightest jack made for its capacity. Weighs considerably less than other jacks of equal power, in some sizes less than half as much.

Sizes for 15 to 100 tons

Easy to operate; a 24-inch handle provides ample leverage. Has a positive check to prevent damage from over-extension. Made of steel throughout.

Bulletin 29 tells all about the Doughboy Jack.

McKiernan-Terry Drill Company

Rock Drills—Pile Hammers—Lifting Jacks—Mining and Quarrying Machinery

19 PARK ROW, NEW YORK

Works at Dover, N. J.

Agencies in the following Cities: Boston, Chicago, Pittsburgh, Cleveland, Detroit, St. Paul, San Francisco, Columbus, O., New Orleans, Philadelphia.

Foreign Representatives: British Steel Piling Co., London, Eng.
Canadian Representative: Canadian Allis-Chalmers, Ltd., Toronto, Can.

CONCRETE FLOOR HARDENER
*Truscon Laboratories, Detroit, Mich.
Anti-Hydro Waterproofing Co., New York.
General Chemical Co., New York.
General Fireproofing Co., Youngstown, Ohio.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders Co., Cleveland, O.
Sonneborn Sons, Inc., L., N. Y. "Lapidolith"

CONCRETE HEATERS
*Hauck Mfg. Co., Brooklyn, N. Y.

CONCRETE MIXERS
*Gray Iron Fdry. Co., Reading, Pa.
*Koehring Co., Milwaukee, Wis.
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Machine Co., Keokuk, Ia.
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Badger Concrete Mixer Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Iowa.
Contractors' Equipment Co., Keokuk, Ia.
Foote Concrete Mchy. Co., Chicago, Ill.
Jaeger Machine Co., Columbus, O.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.
Lansing Co., Lansing, Mich.
Oshkosh Mfg. Co., Oshkosh, Wis.
Schramm & Son, Inc., Chris. D., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Worthington Pump & Mach'y Corp., New York.

CONCRETE PILING. (See Piling, Concrete)

CONCRETE REINFORCEMENT
*National Steel Fabric Co., Pittsburgh, Pa.
*Truscon Steel Co., Youngstown, O.
American Steel & Wire Co., Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Electric Welding Co., Pittsburgh, Pa.
General Fireproofing Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Ryerson & Son., J. T., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

CONDENSERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mach'y Corp., New York.

CONDUIT RODS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Bissell Co., F., Toledo, Ohio.
Waldo Bros. & Bond Co., Boston, Mass.

CONDUITS
Fibre Conduit Co., Orangeburg, N. Y.
Johns-Manville, Inc., New York City
National Fireproofing Co., New York.
National Metal Molding Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

CONTRACTORS' SUPPLIES, DEALERS
(See pages 80-85.)

CONTRACTORS' USED EQUIPMENT
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Forsythe Bros., New York.
*King, Philip T., New York, N. Y.
*Weiss, B. M., Philadelphia, Pa.
Briggs, Inc., Marvin, Brooklyn, New York.
Contractors' Mach. & Supply Co., Pittsburgh, Pa.
Grey Steel Prod. Co., New York.
Reading Engineering Co., New York.
Zelnicker Supply Co., Walter A., St. Louis, Mo.

CONVEYORS, BELT
*Good Roads Mach'y Co., Philadelphia, Pa.
*Weller Mfg. Co., Chicago, Ill.
Barber-Greene Co., Aurora, Ill.
Gifford Wood Co., Hudson, N. Y.
Goodyear Tire & Rubber Co., Akron, O.
Haiss Mfg. Co., Geo., New York.
Imperial Belting Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Portable Mchy. Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Russell Grader Mfg. Co., Minneapolis, Minn.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CONVEYORS, BUCKET
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Weller Mfg. Co., Chicago, Ill.
Atlas Engineering Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford Wood Co., Hudson, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constn. Co., New York.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Republic Rubber Co., Youngstown, O.
Robins Conv. Belt Co., N. Y. C.
Russell Grader Mfg. Co., Minneapolis, Minn.
Webster Mfg. Co., Chicago, Ill.

CONVEYORS, GRAVITY
Standard Conveyor Co., No. St. Paul, Minn.
Mathews Gravity Carrier Co., Ellwood City, Pa.

CRANES, LOCOMOTIVE
*Bucyrus Co., South Milwaukee, Wis.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Hoist & Derrick Co., St. Paul, Minn.
Brown Hoisting Mchy. Co., Cleveland, O.
Browning Co., Cleveland, O.
Davenport Locomotive Works, Davenport, Ia.
Hanna Eng. Works, Chicago, Ill.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill.
Marion Steam Shovel Co., Marion, O.
McMyler Interstate Co., Cleveland, O.
Northwest Engineering Works, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Overland Crane Co., Hammond, Ind.
U. S. Crane Co., Chicago, Ill.

CRANES, TRAVELING
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Terry Mfg. Co., New York.
Brown Hoisting Mchy. Co., Cleveland, O.
Chesapeake Iron Works, Baltimore, Md.
Hanna Eng. Works, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Northern Eng. Works, Detroit, Mich.
Speidel, J. G., Reading, Pa.
Toledo Crane Co., Toledo, Ohio.
U. S. Crane Co., Chicago, Ill.
Universal Crane Co., Cleveland, O.
Whiting Corp'n, Harvey, Ill.

CRANES, WRECKING
*Bucyrus Co., South Milwaukee, Wis.
Browning Co., Cleveland, O.
Industrial Works, Bay City, Mich.
U. S. Crane Co., Chicago, Ill.

CREOSOTED BLOCKS, TIMBER, ETC.
*Republic Creosoting Co., Indianapolis, Ind.
American Creosoting Co., N. Y. C.
American Creosote Works, Inc., N. Orleans, La.
Jennison-Wright Co., Toledo, O.
Southern Paving Constr. Co., Chattanooga, Tenn.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

CREOSOTING AND CREOSOTING OILS
*Barrett Co., New York.
Am. Creosote Wks., Inc., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Southern Creosoting Co., Ltd., Slidell, La.
Southern Paving Const. Co., Chattanooga, Tenn.
Wyckoff Pipe & Creosoting Co., New York.

CRUSHERS AND PULVERIZERS (See Rock Crushers)

CULVERTS, METAL
*Good Roads Machinery Co., Philadelphia, Pa.
*Newport Culvert Co., Newport, Ky.
*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
Canton Culvert & Silo Co., Canton, O.
Concrete Form Co., Inc., Syracuse, N. Y.
Dee Co., W. E., Chicago, Ill.
Galion Iron Works & Mfg. Co., Galion, O.
Hardesty Mfg. Co., The R., Denver, Colo.

KOPPEL Cars, Batch Boxes and Trucks are built with an intimate knowledge of the work they must do. Their use saves time, hurries the work and means increased profits for the contractor.

KOPPEL

Get our Road Catalogue No. 100.

Koppel Industrial Car & Equipment Company
KOPPEL, PENNA.

Sales Offices:
NEW YORK, 30 Church Street
CHICAGO, Peoples Gas Bldg.
PITTSBURGH, Farmers Bank Bldg.
PHILADELPHIA, 1420 Chestnut Street
DETROIT, Book Building
SAN FRANCISCO, Edw. R. Bacon Co., 51 Minna St.

Eureka!

WAUGH Clipper drills, in the hands of Walter Fitch, Junior's, splendid crew of men, have just established a new World's shaft-sinking record—427½ feet of vertical, three-compartment shaft in 31 days at Eureka, Utah. *The Waugh Way Wins.* Write for a Clipper booklet today.

WAUGH

The Denver Rock Drill Mfg. Co.
DENVER, COLORADO

AUTOMATIC LOADING ~ UNLOADING AND CONVEYING MACHINERY

The FAIRFIELD ENGINEERING CO.
LANCASTER, OHIO

FAIRFIELD

DES MOINES TANKS

PLATE WORK
Structural Steel

We design, fabricate, and also erect in any part of the world, structural steel and plate work of every description.

Write for catalogue on the subject in which you are interested.

Pittsburgh-Des Moines Steel Co.
836 Curry Building, Pittsburgh, Pa.

Des Moines, 936 Tuttle Street; New York, 13036 Hudson Terminal; Chicago, 1236 1st Nat'l Bank Bldg.; Washington, 936 Munsey Bldg.; San Francisco, 336 Rialto Bldg.; Dallas, 1236 Praetorian Bldg.; Detroit, 1136 Book Bldg.; Canadian Des Moines Steel Co., Ltd., 236 Inshes Ave., Cantham, Ont.

-DES MOINES-

A Clear and Definite Specification

Avoids Waste By Eliminating Debatable Factors Between Engineers, Contractors, and Material Men.

Upon request, we will send you a copy of a new specification, covering fabric reinforcement for concrete construction, which is clear and definite and fair to all manufacturers of reinforcing fabric.

NATIONAL STEEL FABRIC CO.
Subsidiary of Pittsburgh Steel Co.
709 Union Arcade, Pittsburgh, Pa.

10 Gallon Capacity

CONNERYS'
Tar and Asphalt Heaters

Non-Leakable Welded—"Held by the Weld." 20 Styles.

10 to 1000 Gallon Capacity Carried in Stock.

This kettle (10-gallon capacity) is ideal for road contractors and is especially made for small patch work where there are a considerable number of small holes to be properly filled up with gravel or crushed stone and cemented with bituminous binder. The inside pot lifts out and can readily be used as a pouring pot.

Send your name for illustrated material on all sizes and styles.

CONNERY & CO., Inc.
4000 N. SECOND STREET, PHILADELPHIA, PA.

Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Madison Foundry Co., Cleveland, O.
Russell Grader Mfg. Co., Minneapolis, Minn.
Southern Metal Culvert Co., Salisbury, N. C.
Wheeling Corrugating Co., Wheeling, W. Va.
Wood & Co., R. D., Philadelphia, Pa.

CURB BOXES
*Mueller Mfg. Co., Decatur, Ill.
Casey-Hedges Co., Chattanooga, Tenn.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Foundry Mfg. Co., St. Albans, Vt.
Madison Foundry Co., Cleveland, O.
S. E. T. Valve & Hydrant Co., N. Y. C.
Thompson-Flemming Co., Inc., Buffalo, N. Y.

CURB, STEEL PROTECTED
*Truscon Steel Co., Youngstown, O.
Concrete Steel Co., New York.
National Steel Fabric Co., Pittsburgh, Pa.
Steel Protected Concrete Co., Philadelphia, Pa.

CUTTERS, PIPE, HAND
*Crane Co., Chicago, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., New Haven, Conn.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp'n., Greenfield, Mass.
Reed Mfg. Co., Erie, Pa.
Walworth Mfg. Co., Boston, Mass.

CUTTERS, ROD AND WIRE
*Koehring Co., Milwaukee, Wis.
Carpenter & Co., Geo. B., Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Worthington Pump & Mchy. Corp., New York.

CUTTING AND WELDING APPARATUS
Macleod Co., Cincinnati, O.
Milburn Co., Alexander, Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

DERRICKS, GUY AND STIFF-LEG
*Byers Machine Co., Ravenna, O.
*National Hoisting Engine Co., Harrison, N. J.
*Terry Mfg. Co., New York.
American Hoist & Derrick Co., St. Paul, Minn.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Flory Mfg. Co., S., Bangor, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Lincoln Iron Works, Rutland, Vt.
Smith, Whitcomb & Cook Co., Barrie, Vt.
Superior Iron Works, Superior, Wis.

DERRICKS, PIPE LAYING
*Mueller Mfg. Co., H., Decatur, Ill.
*Terry Mfg. Co., New York.
Austin Machinery Corp'n, Chicago, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

DERRICKS, REVOLVING
*Terry Mfg. Co., New York.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.

DERRICKS, STEEL
*Terry Mfg. Co., New York.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Federal Bridge & Struc. Co., Waukesha, Wis.
Hayward Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, STEEL PORTABLE
*Terry Mfg. Co., New York.
Austin Machinery Corp'n, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Manufacturing Co., New York.
Taylor Portable Steel Derrick Co., Chicago, Ill.

DERRICKS, TRAVELING
*Bay City Dredge Works, Bay City, Mich.
*Byers Machine Co., Ravenna, O.
*Hoisting Engine Sales Co., New York.
*National Hoisting Engine Co., Harrison, N. J.
*Terry Mfg. Co., New York.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Orton & Steinbrenner Co., Chicago, Ill.

DISINFECTING CHEMICALS
*Barrett Co. New York.
*Mathieson Alkali Works, Inc., New York.
Electro Bleaching Gas Co., New York.

DISTRIBUTING PLANTS, CONCRETE
*Koehring Co., Milwaukee, Wis.
*Ransome Concrete Machy. Co., Dunellen, N. J.
Archer Iron Works, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

DITCHING MACHINES (See Excavators, Ditch and Trench)

DOORS AND SHUTTERS, STEEL ROLLING
Cornell Iron Works, New York.
Kinnear Mfg. Co., Columbus, O.
Variety Mfg. Co., Chicago, Ill.
Wilson Corp., J. G., New York.

DRAFTING MACHINES
Universal Drafting Machine Co., Cleveland, O.

DRAWING MATERIALS
American Blue Print Paper Co., Chicago, Ill.
American Lead Pencil Co., New York.
Defiance Mfg. Co., New York.
Dietzgen Co., E., New York.
Economy Draw. Table & Mfg. Co., Adrian, Mich.
Gurley, W. & L. E., Troy, N. Y.
Hamilton Mfg. Co., Two Rivers, Wis.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lietz Co., A., San Francisco, Cal.
Spaulding-Moss Co., Boston, Mass.
Weber & Co., F., Philadelphia, Pa.

DREDGES
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
Ellicott Machine Corp'n., Baltimore, Md.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Osgood Co., The, Marion, O.
Stockton Iron Works, Stockton, Cal.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

DREDGES, DIPPER
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.

DREDGES, HYDRAULIC
*Bucyrus Co., South Milwaukee, Wis.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

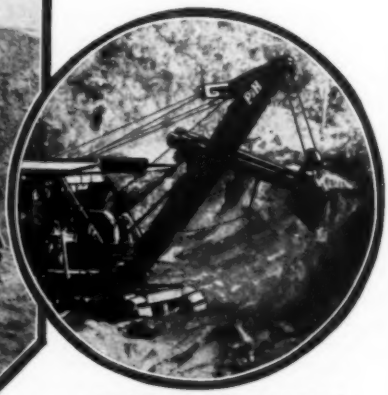
DRILLS, AIR
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, CORE
*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.

DRILLS, HAMMER
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, ROCK
*Denver Rock Drill Mfg. Co., Denver, Colo.

Making Money on Difficult Jobs



P & H Gas Shovel on Bear Creek Road Excavation

WHEN C. Miles, contractor, took the job of unclassified excavation on the Bear Creek Road up in the Santa Cruz Mountains, at a price considerably under the next lowest bid, some veteran contractors shook their heads.

But Mr. Miles had a pretty good idea of how he was going to do the work and make a profit, too. And he did.

He replaced the standard 30-foot boom on his "205" Gasoline-driven Excavator-Crane with the P & H Shovel Attachment, and excavated one side of the road and over-cast to form the other side.

The corduroy traction and comparatively light weight made it possible to negotiate the 15 per cent grade to get to the job, and handle the work easily. The use of gasoline for power eliminated the troubles and expense of hauling fuel and laying a water line required for a steam shovel, and no licensed engineer and fireman were required.

Operating on that isolated, inaccessible mountain side, 6 miles from supply base 3000 feet above sea level, proved no more difficult for the P & H Gasoline Shovel than operating on the average road job.

P & H Gas Shovel Will Increase Your Profits

You can make greater profit by doing the work for less money, if your equipment is right. P & H Excavating Machinery Line is described in the new Bulletin 56X. Copy will be mailed on request.

Excavating Machinery Division

Pawling & Harnischfeger Company

In Milwaukee Since 1884

Offices and Agents in Principal Cities

P&H GAS SHOVEL

When writing to advertisers, please mention the Contractors' & Engineers' Monthly

*McKiernan-Terry Drill Co., New York.
Chicago Pneumatic Tool Co., New York.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.
Wood Drill Works, Paterson, N. J.

DRILLS FOR WELLS AND BLAST HOLES
(See Well Drilling Machinery)

DRUMS, HOLDING
Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT
*Allis-Chalmers Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Ruggles-Coles Eng. Co., New York.
Variety Iron & Steel Works, Cleveland, O.

DUMP BODIES FOR MOTOR TRUCKS
*Heil Company, Milwaukee, Wis.
*International Motor Co., New York.
*Littleford Bros., Cincinnati, O.
American Truck Body Co., Inc., Martinville, Va.
Archer Iron Works, Chicago, Ill.
Auto Truck Steel Body Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Horizontal Hydraulic Hoist Co., Detroit, Mich.
Jennings Automatic Dump Body, Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill.
Pechstein Iron Works, Keokuk, Iowa.
Simplex Mfg. Co., Conneautville, Pa.
Van Dorn Iron Wks., Cleveland, Ohio.
Wood Hydraulic Hoist & Body Co., Detroit, Mich.

DUMP CARTS AND WAGONS, HORSE DRAWN
*Acme Road Machinery Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Tiffin Wagon Co., Tiffin, Ohio.
Acme Wagon Co., Emigsville, Pa.
Arcadia Trailer Corp., Newark, N. Y.
Austin Mfg. Co., Chicago, Ill.
Eagle Wagon Works, Auburn, N. Y.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Stroud & Co., Omaha, Nebr.
Watson Products Corp., Canastota, N. Y.

DUST LAYING AND ROAD BINDER MATERIALS
*Barrett Co., New York.
*Dow Chemical Co., Midland, Mich.
*Standard Oil Co. of Indiana, Chicago, Ill.
Dustoline for Roads Co., Summit, N. J.
Semet-Solvay Co., Solvay, N. Y.
Texas Co., New York.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE
Pacific Flush Tank Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC GENERATORS AND MOTORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Ideal Elec. & Mfg. Co., Mansfield, O.
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.

ELECTRIC LAMPS
*General Electric Co., Schenectady, N. Y.
*Westinghouse Lamp Co., New York.

ELECTRIC LIGHTING PLANTS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Western Electric Co., New York

ELECTRIC MOTORS
*Allis Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Crocker-Wheeler Co., Ampere, N. J.
Lincoln Electric Co., Cleveland, Ohio.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.

ELECTRIC SUPPLIES, METERS, ETC.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Bissell Co., F., Toledo, Ohio.

ELECTRIC TRANSFORMERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, New York.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Kuhlman Electric Co., Bay City, Mich.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

ELEVATORS, BUCKET
*Austin Western Road Machy. Co., Chicago, Ill.
*Fairfield Engineering Co., Lancaster, Ohio.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, Ohio.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Weller Mfg. Co., Chicago, Ill.
Atlas Eng. Co., Milwaukee, Wis.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Robins Conv. Belt Co., N. Y. C.
Webster Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, CONTRACTING MATERIAL
*Byers Machine Co., Ravenna, O.
*Fairfield Engineering Co., Lancaster, Ohio.
*Ransome Concrete Machy. Co., Dunellen, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Insley Mfg. Co., Indianapolis, Ind.

ELEVATORS, FACTORY
*Weller Mfg. Co., Chicago, Ill.
Otis Elevator Co., New York.
Ridgway & Son Co., C., Coatesville, Pa.
Speidel, J. G., Reading, Pa.
Standard Conveyor Co., No. St. Paul, Minn.
Webster Mfg. Co., Chicago, Ill.

ELEVATORS, PASSENGER AND FREIGHT
Haughton Elevator & Machy. Co., Toledo, Ohio.
Otis Elevator Co., New York.
See Elec. Elevator Co., A. B., New York.
Warner Elevator Mfg. Co., Cincinnati, O.

ENGINES, GAS AND GASOLINE
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York.
Domestic Engine & Pump Co., Shippensburg, Pa.
Foos Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
"New-Way" Motor Co., Lansing, Mich.
Novo Engine Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, HIGH DUTY WATER-WORKS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Worthington Pump & Mchy. Corp., New York.

ENGINES, OIL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Fairbanks, Morse & Co., Chicago, Ill.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Advance Rumely Thresher Co., La Porte, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Bush-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Chicago Pneumatic Tool Co., Chicago, Ill.
De La Vergne Machine Co., New York.
Foos Gas Engine Co., Springfield, O.
Ingersoll-Rand Co., New York.
International Harvester Co. of Am., Chicago, Ill.
Machinery Sales Co., Chicago, Ill.
Midwest Engine Co., Indianapolis, Ind.
Weber Engine Co., Kansas City, Mo
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.

The Hall Manufacturing Co.'s Cedar Rapids, Iowa, plant, an example of the use of Elastite in roof construction.

Engineers in all parts of the country are using Elastite in all kinds of concrete construction.

WHY?

Temperature changes cause concrete to expand and contract.

Cracks in any mass of concrete are objectionable.

Expansion cracks can be prevented.

Elastite has made good as an easement for this purpose.

Whether the structure is a road, sidewalk, bridge, dam or roof deck the designer who believes it is better to be safe than sorry specifies, recommends and uses it.

Write for sample and full particulars.

THE PHILIP CAREY COMPANY

9 Wayne Avenue **Lockland, Cincinnati, O.**

*American Well Works, Aurora, Ill.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks Morse & Co., Chicago, Ill.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Gas Engine Co., Kansas City, Mo.
Deming Co., Salem, O.
Enterprise Mchy. Co., Minneapolis, Minn.
Midwest Engine Co., Indianapolis, Ind.
United Iron Works, Inc., Kansas City, Mo.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Nordberg Mfg. Co., Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Erie-Ball Engine Co., Pittsburgh, Pa.
Erie Pump & Engine Co., Medina, N. Y.
Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

ENGINES, TRACTION
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
Oliver Tractor Co., Knoxville, Tenn.
Phoenix Mfg. Co., Eau Claire, Wis.

EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY
*Bucyrus Co., South Milwaukee, Wis.
*Byers Machine Co., Ravenna, O.
Ball Eng. Co., Erie, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Smith Co., T. L., Milwaukee, Wis.

EXCAVATORS, DITCH AND TRENCH
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
* Byers Machine Co., Ravenna, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Keystone Driller Co., Beaver Falls, Pa.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

EXCAVATORS, DRAG-LINE
*Bay City Dredge Works, Bay City, Mich.
*Bucyrus Co., South Milwaukee, Wis.
* Byers Machine Co., Ravenna, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Browning Co., Cleveland, O.
Clyde Iron Works, Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Gade, C. L., Iowa Falls, Iowa.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Northwestern Expanded Metal Co., Chicago, Ill.

EXPANSION JOINT MATERIAL
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.
Texas Company, New York.

EXPLOSIVES
*Du Pont de Nemours & Co., E. I., Wilmington, Del.
Atlas Powder Co., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Hercules Powder Co., Wilmington, Del.

FENCING
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Kitselman Bros., Muncie, Ind.
Pittsburgh Steel Co., Pittsburgh, Pa.
Stewart Iron Works Co., Cincinnati, Ohio.
Texas Cyclone Fence Co., Fort Worth, Tex.
Wickwire Spencer Steel Corp'n, Worcester, Mass.

FILING EQUIPMENT, STEEL
Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
Econ. Drawing Table & Mfg. Co., Adrian, Mich.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER
*Norwood Engineering Co., Florence, Mass.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
American Water Softener Co., Philadelphia, Pa.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewel Filtr. Co., Nutley, N. J.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE APPARATUS, MOTOR
*International Motor Co., New York.
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y.
Brockway Motor Fire App. Co., Cortland, N. Y.
Childs Co., O. J., Utica, N. Y.
Prospect Mfg. Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.

FIRE EXTINGUISHERS, CHEMICAL
American-La France Fire Eng. Co., Elmira, N. Y.
Childs Co., O. J., Utica, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite Firefoam Co., New York.
Pyrene Mfg. Co., New York.

FIREPROOF BUILDING MATERIAL
*Delaware Clay Products Co., Pittsburgh, Pa.
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Corrugated Bar Co., Inc., Buffalo, N. Y.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.
Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.

FIRST AID EQUIPMENT
American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS
*Central Foundry Co., New York.
*Crane Co., Chicago, Ill.
*United Lead Company, New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Lunkenheimer Co., Cincinnati, O.

FLOORS, WOOD BLOCK
*Barrett Co., New York.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Southern Wood Pres. Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS
Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

FORGES
Buffalo Forge Co., Buffalo, N. Y.
Hauck Mfg. Co., Brooklyn, N. Y.

FORM CLAMPS
Insley Mfg. Co., Indianapolis, Ind.
Marion Malleable Iron Works, Marion, Ind.
Universal Form Clamp Co., Chicago, Ill.

Hoists That Lift; Hammers That Drive or Pull

The above line tells in a few words the whole National Hoisting Engine Company's Story. No National Hoist is recommended for a job unless we know that it will do the work. No National Hammer is put to work unless we are sure that it can do the job better than any other hammer on the market.

National Hammers and Hoists are built by engineers who have spent their whole lives in construction work. These men know what the contractor expects from his hoisting or driving equipment, and they have given him:

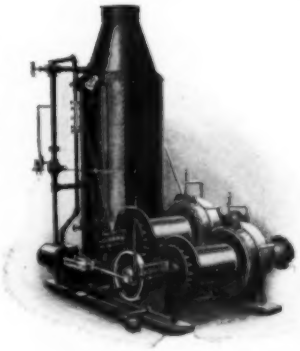
National Hoists That Lift, and National Hammers That Drive or Pull.

Write for the catalogs of the equipment you are interested in.

National Hoisting Engine Co.

Office and Works

Harrison **New Jersey**



NATIONAL

WOLVERINE MIXERS

A Knickerbocker Product

¶ The Wolverine Concrete Mixers successfully fill a big need right now, both in the building field and in the construction of sidewalks, bridges and culverts, for a well made, low priced mixer.

¶ The special design of these mixers, together with the quantity built, permits us to make them the desired weight for portability, and of sufficient strength to withstand the hard work they are subjected to on the job, and still sell them at exceedingly low prices.

THE KNICKERBOCKER CO., 338 Liberty St., JACKSON, MICH., U. S. A.

Knickerbocker Line of Concrete Mixers, Mortar Mixers, Portable Saw Rigs

BAKER MANEY Self-Loading SCRAPERS

They dig, load, haul, dump and spread

Write to

THE BAKER MFG. CO.

503 Stanford Ave., Springfield, Ill.

Everything in Reinforcement for Concrete Roads

Truscon Wire Mesh, furnished in flat sheets cut to length, is a superior reinforcement especially made for concrete highways.

Truscon Road Mesh is an expanded metal with 6″ x 12″ diamond mesh; furnished in flat sheets 5ft. wide and various lengths.

Truscon Curb Bars protect and reinforce the concrete curbs. Positive anchorage; easy to handle and install.

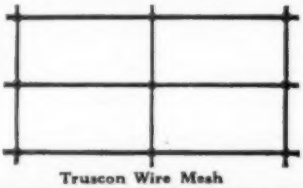
TRUSCON STEEL COMPANY

Youngstown, Ohio

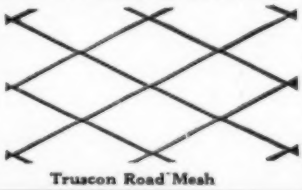
Warehouses and Sales Offices in Principal Cities

TRUSCON STEEL CO. TRUSCON BUILDING PRODUCTS

Truscon Curb Bars



Truscon Wire Mesh



Truscon Road Mesh

FORMS, CONSTRUCTION
*Connery & Co., Philadelphia, Pa.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Concrete Form Co., Inc., Syracuse, N. Y.
Heltzel Steel Form & Iron Co., Warren, O.
Hydraulic Steelcraft Co., Cleveland, O.
Metal Forms Corp., Milwaukee, Wis.

FURNITURE AND FILES, STEEL
Art Metal Constn. Co., Jamestown, N. Y.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works Co., Cleveland, O.

GARBAGE CANS. (See Cans)

GARBAGE DISPOSAL
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
Decarie Incinerator Co., Minneapolis, Minn.
Destructor Co., New York.
Jeffrey Manufacturing Co., Columbus, O.
Morse-Boulger Destructor Co., New York.
Nye Odoriess Crematory Co., Macon, Ga.

GARBAGE TRUCKS AND WAGONS
*Austin Western Road Mchy. Co., Chicago, Ill.
*Autocar Co., Ardmore, Pa.
*International Motor Co., New York.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, O.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Holabog & Bro., Geo. H., Jeffersonville, Ind.
Lee Trailer & Body Co., Chicago, Ill.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

GAS ENGINES. (See Engines, Gas and Gasoline.)

GAS METERS
*Builders Iron Foundry, Providence, R. I.
*General Electric Co., Schenectady, New York.
*Pittsburg Meter Co., East Pittsburgh, Pa.

GAS PRODUCERS
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Camden Iron Works, Camden, N. J.

GASOLINE STORAGE TANKS
*Byers Machine Co., Ravenna, O.
*Heil Co., Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Biggs Boiler Works, Akron, Ohio.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Chicago Bridge & Iron Works, Chicago, Ill.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Kansas City, Mo.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

GATES, SLUICE
*Crane Co., Chicago, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y.
Columbian Iron Works, Chattanooga, Tenn.
Eddy Valve Co., Waterford, N. Y.
Hardesty Mfg. Co., The, Denver, Col.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

GAUGES, RECORDING, PRESSURE, STEAM
Bristol Co., Waterbury, Conn.
Crosby Steam Gauge & Valve Co., Boston, Mass
Marsh & Co., Jas. P., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y
U. S. Gauge Co., New York.

GAUGES, WATER
Bristol Co., Waterbury, Conn.
Clow & Sons, J. B., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
United States Gauge Co., New York.
Walworth Mfg. Co., Boston, Mass.

GAUGES, SURFACE, RESERVOIR AND SPECIAL WATER-WORKS
*Builders Iron Foundry, Providence, R. I.
Clark Co., H. W., Mattoon, Ill.
Simplex Valve & Meter Co., Philadelphia, Pa.

GLASS, FIREPROOF. (See Wire Glass.)

GRADERS, ROAD
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mchy. Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Koehring Co., Milwaukee, Wis.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Mfg. Co., Minneapolis, Minn.

GRINDERS AND SAND RAMMERS
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Ingersoll-Rand Co., New York, N. Y.
Sullivan Machinery Co., Chicago, Ill.

GYPSUM PRODUCTS
U. S. Gypsum Co., Chicago, Ill.

HAMMERS, STEAM, PILE. (See Pile Hammers, Steam.)

HEAT INSULATING MATERIAL
*Carey Co., Philip, Cincinnati, Ohio.
John-Manville, Inc., New York.

HEATING KETTLES. (See Kettles)

HOISTS, BELT-DRIVEN
*Weller Mfg. Co., Chicago, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mundy Hoisting Engine Co., J. S., Newark, N. J.

HOISTS, CONCRETE, TOWER
*Ransome Concrete Machy. Co., Dunellen, N. J.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

HOISTS, CONTRACTORS', ELECTRIC
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Bay City Dredge Works, Bay City, Mich.
*Byers Machine Co., Ravenna, O.
*Fairbanks, Morse & Co., Chicago, Ill.
*National Hoisting Engine Co., Harrison, N. J.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Hoist & Derrick Co., St. Paul, Minn.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Flory Mfg. Co., S., Bangor, Pa.
Ingersoll-Rand Co., New York.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
Northern Eng. Works, Detroit, Mich.
Treadwell Eng. Co., Easton, Pa.

HOISTS, CONTRACTORS', GASOLINE
*Bay City Dredge Works, Bay City, Mich.
*National Hoisting Engine Co., Harrison, N. J.
*Waldo Bros. & Bond Co., Boston, Mass.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Mach. Co., Keokuk, Ia.
Austin Machinery Corp'n, Chicago, Ill.
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Construction Machy. Co., Waterloo, Iowa.
Domestic Engine & Pump Co., Shippensburg, Pa.
Flory Mfg. Co., S., Bangor, Pa.
Lansing Co., Lansing, Mich.
Lidgerwood Mfg. Co., New York.
Monighan Machine Co., Chicago, Ill.
Mundy Hoisting Engine Co., J. S., Newark, N. J.
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Mach. Co., Columbia, Pa.
Schramm & Son, Inc., Chris. D., West Chester, Pa.

HOISTS, CONTRACTORS', STEAM
*Byers Machine Co., Ravenna, O.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*National Hoisting Engine Co., Harrison, N. J.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Flory Mfg. Co., S., Bangor, Pa.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Ingersoll-Rand Co., New York.
Insley Mfg. Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.
Treadwell Eng. Co., Easton, Pa.

HOISTS, HYDRAULIC FOR MOTOR TRUCKS
*Heil Co., The Milwaukee, Wis.
Horizontal Hydr. Hoist Co., Detroit, Mich.
Wood Hydr. Hoist & Body Co., Detroit, Mich.

HOISTS, PNEUMATIC
*Denver Rock Drill Mfg. Co., Denver, Colo.
Chicago Pneumatic Tool Co., New York.
Detroit Hoist & Machine Co., Detroit, Mich.
Flory Mfg. Co., Bangor, Pa.
Hanna Eng. Works, Chicago, Ill.

Porter Locomotives

are the choice of that class of buyers who demand equipment that will do the work well, with a record of many years of successful operation.

H. K. PORTER COMPANY
PITTSBURGH, PA.

TERRY

For a Quarter of a Century Building all Types of

CRANES

DERRICKS

TERRY MANUFACTURING COMPANY
Grand Central Terminal
New York City
Plant—Kearny, Newark, N. J.

Welded Tanks for Every Purpose

This Hydro Pneumatic Tank is built for a working pressure of 100 pounds. We manufacture a complete line of Storage Tanks for gasoline and road oil, Underground Tanks, Air Receivers and Special Tanks, Dump Bodies and Hydro Hoists for Motor Trucks.

Quality TANKS BODIES & HOISTS "Made by Heil"

Steel Stacks

for power plants are completely fabricated in our plant and shipped in several sections for erection. Send your specifications.

THE HEIL CO.

1243 26th Ave., Milwaukee, Wis.
Distributors in Principal Cities

Style No. 69. Plain and Roller Bearings

LITTLEFORD TAR & ASPHALT HEATERS

Are Better—Much Better.

Made in Various Styles of Different Capacities. Send for Descriptive Literature.

Complete Equipment for Paving Contractors and Municipalities.

Pouring Pots and Asphalt Paving Tools. Tool Heaters.

Also the Andresen Road Repair Outfit.

LITTLEFORD BROS.
500 E. PEARL ST. CINCINNATI, O.

Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Northern Engineering Works, Detroit, Mich.
Worthington Pump & Mchy. Corp., New York.

HOLLOW TILE
*Delaware Clay Products Co., Pittsburgh, Pa.
Bannon Pipe Co., P., Louisville, Ky.
Dee Co., Wm. E., Chicago, Ill.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Medal Paving Brick Co., Cleveland, Ohio.
Metropolitan Paving Brick Co., Canton, Ohio.
National Fireproofing Co., Pittsburgh, Pa.

HOPPERS, CONCRETE
*Honhorst Co., Jos., Cincinnati, O.
*Koehring Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Weller Mfg. Co., Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
Lakewood Engineering Co., Cleveland, O.

HOSE, AIR
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodyear Tire & Rubber Co., Akron, O.
Ingersoll-Rand Co., New York.
Penna Flexible Metallic Tubing Co., Phila., Pa.
Republic Rubber Co., Youngstown, O.
U. S. Rubber Co., New York

HOUSES, PORTABLE. (See Buildings, Portable)

HYDRANTS, FIRE
*Smith Mfg. Co., A. P., East Orange, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Mfg. Co., Waterford, N. Y.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Norwood Engineering Co., Florence, Mass.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

INCINERATORS, GARBAGE. (See Garbage Disposal)

INDICATOR POSTS. (See Valves)

INSPECTING LABORATORIES
Allentown Testing Laboratories, Allentown, Pa.
Conard & Busby, Burlington, N. J.
Hunt & Co., Robert W., Chicago, Ill.
Pittsburgh Testing Laboratories, Pittsburgh, Pa.

INSTRUMENTS AND SUPPLIES. (Surveyors' and Engineers')
Ainsworth & Sons, Wm., Denver, Col.
Aloe Co., A. S., St. Louis, Mo.
Berger & Sons, C. L., Boston, Mass.
Brandis & Sons Mfg. Co., Brooklyn, N. Y.
Buff & Buff Mfg. Co., Boston, Mass.
Dietzgen Co., Eugene, Chicago, Ill.
Gurley, W. & L. E., Troy, N. Y.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lietz Co., A., San Francisco, Cal.
Leupold & Voelpel, Portland, Ore.
Pfister, Wm. H., Cincinnati, O.
Ulmer, J. C., Co., Cleveland, Ohio.
Weber & Co., F., Philadelphia, Pa.
White Co., David, Milwaukee, Wis.
Wissler Instrument Co., St. Louis, Mo.

IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

JACKS, LIFTING
*Duff Mfg. Co., Pittsburgh, Pa.
*McKiernan-Terry Drill Co., New York.
Buda Company, Chicago, Ill.
Iron City Prod. Co., Pittsburgh, Pa.
Joyce-Cridland Co., Dayton, O.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Norton, Inc., A. O., Boston, Mass.
Watson-Stillman Company, New York.

JACKS, PIPE FORGING
*Duff Mfg. Co., Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.

JOINTS, EXPANSION PAVING
*Carey Company, Philip, Cincinnati, O.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Waring-Underwood Co., Philadelphia, Pa.

JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

KETTLES, FOR ASPHALT AND TAR HEATING
*Acme Road Mach. Co., Frankfort, N. Y.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Good Roads Machinery Co., Kennett Square, Pa.
*Honhorst Co., Jos., Cincinnati, O.
*Littleford Bros., Cincinnati, O.
Hauck Mfg. Co., Brooklyn, N. Y.
Macleod Co., Cincinnati, O.
Stuebner Iron Wks., G. L., Long Island City, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N. Y.

LATH, METAL
*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Bostwick Steel Lath Co., Niles, O.
Consol. Expanded Metal Co., Braddock, Pa.
Corrugated Bar Co., Inc., Buffalo, N. Y.
General Fireproofing Co., Youngstown, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Northwestern Expanded Metal Co., Chicago, Ill.
Penn Metal Co., Boston, Mass.
Sykes Metal Lath & Roofing Co., Niles, O.
Wickwire Spencer Steel Corp., Worcester, Mass.
Youngstown Pressed Steel Co., Warren, O.

LEADITE
Leadite Co., The, Philadelphia, Pa.

LEAD-MELTING FURNACES
Berns, Otto, Co., Newark, N. J.
Chicago Flexible Shaft Co., Chicago, Ill.
Gilbert & Barker, Springfield, Mass.
Hauck Mfg. Co., Brooklyn, N. Y.
Stuebner Iron Works, Long Island City, N. Y.

LEAK FINDERS
*Pitometer Company, New York.
Clark & Co., H. W., Mattoon, Ill.

LETTERS AND FIGURES, METAL
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS
*General Elec. Co., Schenectady, N. Y.
Carbic Mfg. Co., Duluth, Minn.
Hauck Mfg. Co., Brooklyn, N. Y.
Macleod Co., Cincinnati, O.
Milburn Co., Alex., Baltimore, Md.
Prest-O-Lite Co., Inc., New York.

LIGHTING STANDARDS
*Electric Railway Equip. Co., Cincinnati, O.
*King Mfg. Co., Chicago, Ill.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Clow & Sons, J. B., Chicago, Ill.
Stewart Iron Works Co., Cincinnati, O.
Union Metal Mfg. Co., Canton, O.

LIQUID CHLORINE
*Electro Bleaching Gas Co., New York.
*Mathieson Alkali Works, Inc., New York.
*Penna. Salt Mfg. Co., Philadelphia, Pa.

LOADERS, GRAVEL AND WAGON
*Bay City Dredge Works, Bay City, Mich.
*Fairfield Engineering Co., Lancaster, O.
*Weller Mfg. Co., Chicago, Ill.
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Barber-Greene Co., Aurora, Ill.
Bonney Supply Co., Inc., Rochester, N. Y.
Economy Excavator Co., Iowa Falls, Iowa.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Haiss Mfg. Co., Geo., New York.
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Portable Mchy. Co., Passaic, N. J.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Sauerman Bros., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.

LOCK BAR STEEL PIPE
*East Jersey Pipe Co., New York

LOCKERS, STEEL
Hart & Hutchinson Co., New Britain, Conn.
Medart Mfg. Co., Fred., St. Louis, Mo.

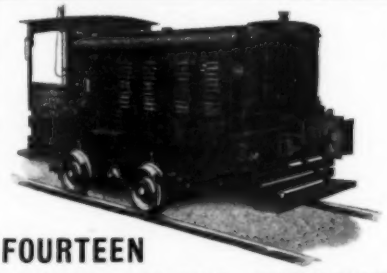
LOCOMOTIVES, FOR CONTRACTORS, ETC.
*Cummings Mach. Co., Minster, O.
*Koppel Industrial Car & Equip. Co., Koppel, Pa.
*Porter Co., H. K., Pittsburgh, Pa.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Locomotive Co., New York, N. Y.
Austin Machinery Corp'n, Chicago, Ill.
Baldwin Locomotive Works, Philadelphia, Pa.
Burton Eng. & Mach. Co., Cincinnati, O.
Crapster, Herbert, New York.
Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, O.
Hadfield-Penfield Steel Co., Bucyrus, O.

On every road building and hauling job the "Caterpillar"* *motorized method* shows big savings. The 10-ton "Caterpillar"* keeps big graders working at top efficiency. The 5-ton, pulling a train of dump wagons, will move *more dirt or gravel* in *less time* than is possible with teams. Send for our booklet, "The Nation's Road-Maker."

THE HOLT MFG. CO., Inc.
PEORIA, ILLINOIS
Eastern Division: 50 Church St., New York
Branches and service stations all over the world.

CATERPILLAR
Reg. U.S. Pat. Off.
HOLT
PEORIA, ILL.
STOCKTON, CALIF.

** There is but one "CATERPILLAR"—Holt builds it*



FOURTEEN
CUMMINGS GASOLINE LOCOMOTIVES
of the six ton type are daily giving remarkable, uninterrupted service under severe haulage and operating conditions for Twohy Brothers in the construction of 315 miles of concrete road in Maricopa County, Arizona.
You too will find these locomotives equally valuable and indispensable on your road building projects—large or small.

THE CUMMINGS MACHINE CO.
MINSTER, OHIO
HERBERT CRAPSTER
General Sales Manager
1 Madison Ave. New York, N. Y.

PIONEER Highest Quality ASPHALTS

"PIONEER"

PIONEER Highest Quality ASPHALTS

Pioneer Paints

Contractors prepare for the winter lay-up of your machinery. Paint it with a good preservative paint. You will find it well worth the trouble and expense. "PIONEER" Paints are especially made for this purpose. Let us quote you on your requirements.

"PIONEER"

The end of the season demands SUPER-service. Special attention given to rush orders. There is a "PIONEER" product for every asphalt use.

THE PIONEER ASPHALT CO., Lawrenceville, Ill.

Lima Locomotive Wks., Lima, O.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

LUMBER, HEAVY CONSTRUCTION
Brown Co., Portland, Me.
Crowell & Spencer Lumber Co., Long Leaf, La.
Great Southern Lumber Co., Bogalusa, La.
Industrial Lumber Co., Elizabeth, La.
Long Bell Lumber Co., Kansas City, Mo.
Sargent Lumber Co., Little Rock, Ark.
Sterner Co., Inc ., E. J., New York.
Weyerhaeuser Sales Co., Spokane, Wash.

LUMBER, STEEL
*Truscon Steel Co., Detroit, Mich.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
National Pressed Steel Co., Massillon, O.
Northwestern Exp. Metal Co., Chicago, Ill.

MANHOLE COVERS (See Catch Basins)

METAL LATH. (See "Lath")

METAL ROOFING (See "Roofing)

METER BOXES
*Mueller Mfg. Co., H., Decatur, Ill.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Ford Meter Box Co., Wabash, Ind.
Foundry Mfg. Co., St. Albans, Vt.
McNutt Meter Box Co., Brazil, Ind.
S. E. T. Valve & Hydrant Co., New York.

METER COUPLINGS
*Mueller Mfg. Co., H., Decatur, Ill.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Clark Co., H. W., Mattoon, Ill.
Ford Meter Box Co., Wabash, Ind.
McNutt Meter Box Co., Brazil, Ind.

METER TESTERS
*Buffalo Meter Co., Buffalo, N. Y.
*Mueller Mfg. Co., H., Decatur, Ill.
*National Meter Co., New York.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
Clark Co., H. W., Mattoon, Ill.
Ford Meter Box Co., Wabash, Ind.

METERS, WATER
*Badger Meter Mfg. Co., Milwaukee, Wis.
*Builders Iron Fdry., Providence, R. I.
*Buffalo Meter Co., Buffalo, New York.
*Hersey Mfg. Co., Boston, Mass.
*National Meter Co., New York.
*Neptune Meter Co., New York.
*Pittsburgh Meter Co., E. Pittsburgh, Pa.
*Thomson Meter Co., Brooklyn, N. Y.
Gamon Meter Co., Newark, N. J.
Simplex Valve & Meter Co., Philadelphia, Pa.
Worthington Pump & Mchy. Corp., New York.

MIXERS, CONCRETE. (See Concrete Mixers.)

MIXERS, GROUT
American Cement Mchy. Co., Keokuk, Ia.
Kent Machine Co., Kent, O.
Lakewood Engineering Co., Cleveland, O.
Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT
*Barber Asphalt Paving Co., Philadelphia, Pa.
Austin Machinery Corp'n, Chicago, Ill.
Kent Machine Co., Kent, O.

MIXERS, MORTAR
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Machy. Co., Dunellen, N. J.
*Standard Scale & Supply Co., Pittsburgh, Pa.
American Cement Machine Co., Keokuk, Ia.
Austin Machinery Corp'n, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Kent Machine Co., Kent, O.
Lansing Co., Lansing, Mich.
Lakewood Engineering Co., Cleveland, Ohio.
Smith Co., T. L., Milwaukee, Wis.

MOTOR TRUCKS
*Autocar Co., Ardmore, Pa.
*General Motors Truck Co., Pontiac, Mich.
*International Motor Co., New York.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, Ohio.
*Winther Motor Truck Co., Kenosha, Wis.
Acason Motor Truck Co., Detroit, Mich.
Acme Motor Truck Co., Cadillac, Mich.
All American Truck Co., Chicago, Ill.
Atterbury Motor Car Co., Buffalo, N. Y.
Bessemer Motor Truck Co., Grove City, Pa.
Brockway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Corbitt Motor Truck Co., Henderson, No. Car.
Denby Motor Truck Co., Detroit, Mich.
Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Garford Motor Truck Co., Lima, O.
Gary Motor Truck Co., Gary, Ind.
Gramm Bernstein Motor Truck Co., Lima, O.
Indiana Truck Corp'n., Marion, Ind.
Jackson Motors Corp'n., Jackson, Mich.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N.Y.
Nash Motors Co., Kenosha, Wis.
Nelson Motor Truck Co., Saginaw, Mich.
Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Selden Truck Corp'n Co., Rochester, N. Y.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n., Buffalo, N. Y.
Titan Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
Velie Motors Corpn., Moline, Ill.
Ward LaFrance Truck Co., Elmira, N. Y.
Watson Products Corp'n., Canastota, N. Y.
Wilson Co., J. C., Detroit, Mich.

MOULDS, CONCRETE
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.

OAKUM
Wall Rope Works, Beverly, N J.

OIL, ROAD
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. of Indiana, Chicago, Ill.
Atlantic Refining Co., Philadelphia, Pa.
Headley Good Roads Co., Philadelphia, Pa.
Pierce Oil Corp., New York.
Sinclair Refining Co., Chicago, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.) Newark, N. J.
Texas Company, New York.
U. S. Asphalt Refining Co., New York.

PACKING, WATER PIPE
*Union Water Meter Co., Worcester, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

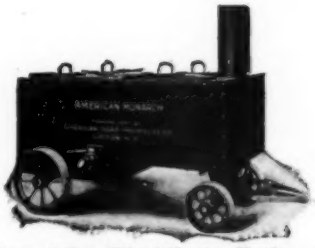
PAINTS, METAL PROTECTION
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
*Truscon Laboratories, Detroit, Mich.
Acme White Ld. & Col. Works, Detroit, Mich.
Berry Bros., Detroit, Mich.
Cook Paint & Varnish Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Dixon Crucible Co., Jos., Jersey City, N J.
Longman & Martinez, New York.
Martin-Senour Co., Chicago, Ill.
Minwax Co., New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Semet-Solvay Co., Syracuse, N. Y.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Toch Bros., New York.

PAPERS, BLUE PRINT AND BROWN PRINT
Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

PAPER, BUILDING, ROOFING, ETC.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, O.
Bird & Son, E. Walpole, Mass.
Brown Co., Portland, Me.

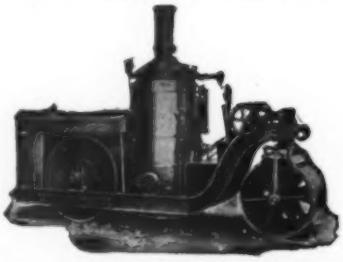
IF IT'S MADE WELL IT WILL WORK WELL

If a machine is inferior in design and poorly made it will not give satisfaction. If, on the other hand, it is well made and properly designed it will work well and prove to be a good investment.



Monarch Four Wheel Heating Kettle, Our Kettles are made in 50, 100, 150, 200, 300, and 500 gallon sizes.

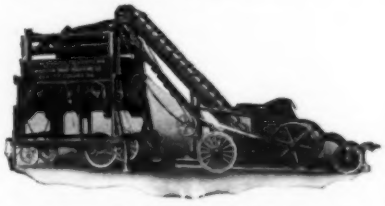
It pays to buy high class Road Building Machinery made by a reliable concern. That is the kind we have been selling for more than forty years. Our machines work well, last well and pay well because they have quality built into them.



Monarch Tandem Road Roller. Made in 5, 6, 8 and 9 ton sizes.

Monarch Oiling Machine for applying oil under pressure. Made either to be drawn by horses or to be mounted on auto trucks.

We make: Rock Crushers, Road Rollers, Road Graders, Heating Kettles, Oiling Machinery, Culvert Pipe, Road Drags and Snow Plows.



Champion Crusher, Mounted with Elevator, Screen, and Portable Stone Bin. Made in many sizes from 50 to 300 tons daily capacities.

Ask for Catalogue
Everything for the Road Maker

THE GOOD ROADS MACHINERY COMPANY, Inc.
KENNETT SQUARE, PA.

Branch Offices in all Principal Cities

Hydrex Asphalt Products Corp., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

PAVING AND ROAD ROLLERS (See Road and Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD
American Creosote Wks., Inc., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Protexol Corpn., New York.
Republic Creosoting Co., Youngstown, O.
Wyckoff Pipe & Creosoting Co., New York.

PAVING BRICK
*Metropolitan Paving Brick Co., Canton, O.
Alton Brick Co., Alton, Ill.
Barr Clay Co., Streator, Ill.
Binghamton Brick Co., Binghamton, N. Y.
Burton Townsend Co., Zanesville, O.
Flint Brick Co., Des Moines, Ia.
Hydraulic Press Brick Co., St. Louis, Mo.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kas.
Poston Paving Brick Co., Crawfordsville, Ind.
Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Sterling Brick Co., Olean, N. Y.
Thurber Brick Co., Thurber, Texas.
Veedersburg Paver Co., Veedersburg, Ind.

PAVING MACHINERY
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo-Springfield Roller Co., Springfield, O.
*Equitable Asphalt Main. Co., Kansas City, Mo.
*Koehring Machine Co., Milwaukee, Wis.
*Warren Bros. Co., Boston, Mass.
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp'n, Chicago, Ill.
Badger Concrete Mixer Co., Milwaukee, Wis.
Construction Machinery Co., Waterloo, Ia.
Cummer & Son Co., F. D., Cleveland, O.
East Iron & Machine Co., Lima, O.
Erie Machine Shops, Erie, Pa.
Judy Mfg. Co., Centerville, Ia.
Lakewood Engineering Co., Cleveland, O.

PAVING MATERIALS (See "Asphalt," "Paving Brick," "Granite Block," etc.)

PAVING MIXERS. (See Concrete Mixers)

PAVING TOOLS
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Co., Cincinnati, O.
*Warren Bros. Co., Boston, Mass.
Anderson Tool & Sup. Co., W. H., Detroit, Mich.
Kramer Bros. Fdry. Co., Dayton, O.
Union Iron Works, Hoboken, N. J.

PERFORATED METALS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PICKS
Hubbard Co., Pittsburgh, Pa.
Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.

PILE DRIVERS
*McKiernan-Terry Drill Co., New York.
Browning Co., Cleveland, O.
Clyde Iron Works, Duluth, Minn.
Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
McMyler Interstate Co., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM
*McKiernan-Terry Drill Co., New York.
*National Hoisting Eng. Co., Harrison, N. J.
Clyde Iron Works, Duluth, Minn.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

PILING, CONCRETE
McArthur Concrete Pile & Foundation Co., N. Y.
Raymond Concrete Pile Co., New York.

PILING, INTERLOCKING STEEL
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PIPE, CAST IRON
*Central Foundry Co., New York.
*Lynchburg Fdry. Co., Lynchburg, Va.
*U. S. Cast Iron Pipe & Fdy. Co., Burlington, N.J.
American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, J. B., Chicago, Ill.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
National Cast Iron Pipe Co., Birmingham, Ala.
Warren Fdry. & Machine Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE, CORR. METAL.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Newport Culvert Co., Newport, Ky.
Canton Culvert & Silo Co., Canton, O.
Hardesty Mfg. Co., Denver, Col.

PIPE, LEAD
*United Lead Company, New York.

PIPE, REINFORCED CONCRETE
Lock Joint Pipe Co., E. Orange, N. J.
Massey Concrete Products Corp'n, Chicago, Ill.

PIPE, RIVETED STEEL
*Connery & Co., Inc., Philadelphia, Pa.
*East Jersey Pipe Co., New York.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros. Cincinnati, Ohio.
*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
*Weller Mfg. Co., Chicago, Ill.
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Pa.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Hammond Iron Works, Warren, Pa.
Hardesty Mfg. Co., R., Denver, Col.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Tippet & Wood, Phillipsburg, N. J.

PIPE, SPIRAL RIVETED
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.

PIPE STEEL
*East Jersey Pipe Co., New York.
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD
*American Wood Pipe Co., Tacoma, Wash.
*Continental Pipe Mfg. Co., Seattle, Wash.
*Pacific Tank & Pipe Co., San Francisco, Cal.
*Redwood Mfrs. Co., San Francisco, Cal.
Michigan Pipe Co., Bay City, Mich.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON
Byers Co., A. M., Pittsburgh, Pa.
Reading Iron Co., Reading, Pa.

PIPE COVERING

AIRCELL
*Carey Co., Philip, Cincinnati, O.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Nat'l Asbestos Co., Jersey City, N. J.
Norristown Magnesia & Asbestos Co., Norristown, Pa.
Sall Mt. Asbestos Co., Chicago, Ill.
Watson Co., H. F., Erie, Pa.

85 PER CENT MAGNESIA
*Carey Co., Philip, Cincinnati, O.
Ehret Magnesia Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.

WOOD
*Continental Pipe Mfg. Co., Seattle, Wn.
*Redwood Mfrs. Co., San Francisco, Cal.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS
*Builders Iron Fdry, Providence, R. I.
*Central Foundry Co., New York.
*Crane Co., Chicago, Ill.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
American C. I. Pipe Co., Birmingham, Ala.
Clow & Sons, J. B., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

PATENT COMBINATION
Auto Heater and Distributor

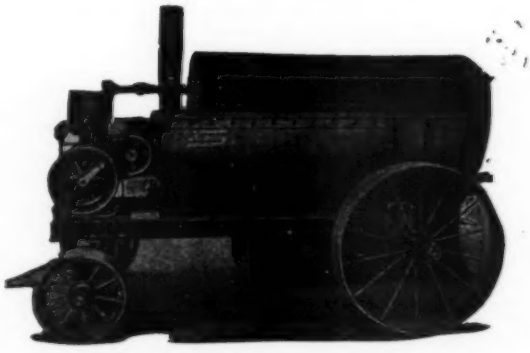
QUALITY
Kinney
EFFICIENCY

HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street
BOSTON, MASSACHUSETTS

BRANCHES:

NEW YORK PHILADELPHIA CHICAGO HOUSTON KANSAS CITY SAN FRANCISCO

Warren Fdry. & Mach. Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY
*Mueller Mfg. Co., H., Decatur, Ill.
Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND, SEWER
*Carey Co., Philip, Cincinnati, O.
*Waring-Underwood Co., Philadelphia, Pa.
Leadite Company, Inc., Philadelphia, Pa.
Pacific Flush Tank Co., Chicago, Ill.
Ruberoid Co., New York.

PIPE JOINT MATERIAL, CAST IRON
Lead-Hydro-Tite Co., Boston, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Co., New York.

PLOWS, CONTRACTORS
*Burch Plow Works Co., Crestline, O.
*Holt Mfg. Co., Peoria, Ill.
American Steel Scraper Co., Sidney, O.
Case Threshing Machine Co., J. I., Racine Wis.
Deere & Co., Moline, Ill.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
International Harvester Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Moline Plow Co., Moline, Ill.
Oliver Chilled Plow Works, South Bend, Ind.
Russell Grader Mfg. Co., Minneapolis, Minn.
Sidney Steel Scraper Co., Sidney, O.
Slusser-McLean Scraper Co., Sidney, O.
Western Wheeled Scraper Co., Aurora, Ill.
Wiard Plow Co., Batavia, N. Y.

PLUMBING SUPPLIES
*Crane Co., Chicago, Ill.
*Mueller Mfg. Co., H., Decatur, Ill.
Clow & Sons, J. B., Chicago, Ill.
Glauber Brass Mfg. Co., Cleveland, O.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
United Brass Mfg. Co., Cleveland, O.
Walworth Mfg. Co., Boston, Mass.

POLES, STEEL STRUCTURAL
*Electric Railway Equipment Co., Cincinnati, O.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.

PORTABLE BUILDINGS
*Littleford Bros., Cincinnati, Ohio.
*Truscon Steel Co., Youngstown, O.
Blaw-Knox Co., Pittsburgh, Pa.
Pruden Co., C. D., Baltimore, Md.

PORTABLE STEEL DERRICKS. (See Derricks, Steel Portable.)

PORTLAND CEMENT. (See Cement.)

POWDER. (See Explosives.)

PUMPS, AIR LIFT
*Indiana Air Pump Co., Indianapolis, Ind.
Harris Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

PUMPS, BOILER FEED
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Indiana Air Pump Co., Indianapolis, Ind.
*Lea-Courtenay Co., Newark, N. J.
Advance Pump & Compr. Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
De Laval Steam Turine Co., E. Treinon, N. J.
Deming Co., Salem, O.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Northern Fire Apparatus Co., Minneapolis, Minn.
Scranton Pump Co., Scranton, Pa.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Indiana Air Pump Co., Indianapolis, Ind.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Camden Iron Works, Camden, N. J.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Erie Pump & Engine Works, Medina, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
Lea-Courtenay Co., Newark, N. J.
Manistee Iron Wks., Manistee, Mich.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
Schramm & Son, Inc., Chris. D., West Chester, Pa.
United Iron Works, Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mchy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

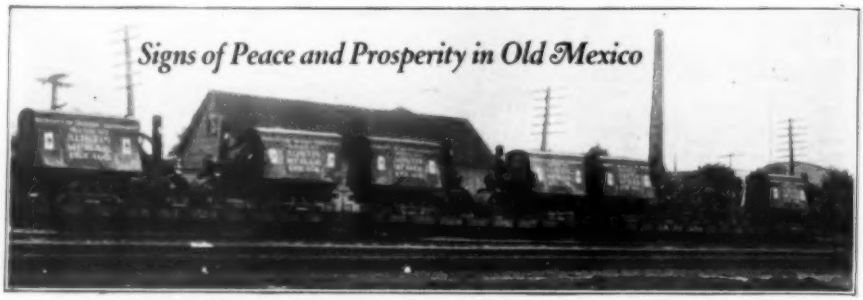
PUMPS, CONTRACTORS'
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Standard Scale & Supply Co., Pittsburgh, Pa.
Barnes Mfg. Co., Mansfield, O.
C. H. & E. Mfg. Co., Milwaukee, Wis.
Cameron Steam Pump Works, A. S., New York.
Construction Mach'y Co., Waterloo, Ia.
Deming Co., Salem, Ohio.
Domestic Engine & Pump Co., Shippensburg, Pa.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Lea-Courtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Midwest Engine Co., Indianapolis, Ind.
Morris Machine Works, Baldwinsville, N. Y.
New York Eng. Co., New York.
Northern Fire App. Co., Minneapolis, Minn.
Novo Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Schramm & Son, Inc., Chris. D., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Universal Motor Co., Oshkosh, Wis.
Van Nouhuys Machine Wks., Albany, N. Y.
Waldo Bros. & Bond Co., Boston, Mass.

PUMPS, DEEP WELL
*American Well Works, Aurora, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Indiana Air Pump Co., Indianapolis, Ind.
*Nordberg Mfg. Co., Milwaukee, Wis.
Aldrich Pump Co., Allentown, Pa.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Cook, Inc., A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Goulds Mfg. Co., Seneca Falls, N. Y.
Keystone Driller Co., Beaver Falls, Pa.
Layne & Bowler Co., Memphis, Tenn.
Midwest Engine Co., Indianapolis, Ind.
United Iron Works, Kansas City, Mo.
Weber Subterranean Pump Co., New York.

PUMPS, DREDGING
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*American Well Works, Aurora, Ill.
Aldrich Pump Co., Allentown, Pa.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Wks., A. S., New York.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Morris Machine Works, Baldwinsville, N. Y.
Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
Wood & Co., R. D., Philadelphia, Pa.
Worthington Pump & Mchy. Corp., New York.

PUMPS, GASOLINE AND OIL
*Kinney Mfg. Co., Boston, Mass.
Bowser & Co., S. F., Fort Wayne, Ind.
Northern Fire App. Co., Minneapolis, Minn.
Worthington Pump & Mach. Corp., New York.

PUMPS, POWER
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Indiana Air Pump Co., Indianapolis, Ind.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Nordberg Mfg. Co., Milwaukee, Wis.
*Northern Fire Apparatus Co., Minneapolis, Min.
Alamo Iron Works, San Antonio, Tex.
American Steam Pump Co., Battle Creek, Mich.
American Well Works, Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
De Laval Steam Turbine Co., Trenton, N. J.



Trainload of Austin Motor Rollers and Road Machinery sold to the Mexican Government.

To be used successfully in the out-of-way corners of the world, road building equipment must be absolutely dependable; first, last and all the time.

Austin-Western machinery can be found in most of these corners, giving the same lasting service and satisfaction that distinguish it at home.

The Austin-Western Road Machinery Co.
CHICAGO
BRANCHES IN 22 CITIES

EXPORT DEPARTMENT
ALMACO ALLIED MACHINERY COMPANY OF AMERICA ALMACO

Buffalo-Pitts and Kelly-Springfield Rollers—Steam and Motor

All Types and Sizes

With or without Scarifier attachment.

Helps you finish the job on time.

Send for catalog A for complete information.

THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD -:- OHIO

Deming Co., Salem, O.
Domestic Eng. & Pump Co., Shippensburg, Pa.
Gardner Governor Co., Quincy, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Goulds Mfg. Co., Seneca Falls, N. Y.
Lawrence Machine Co., Lawrence, Mass.
Lea-Courtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Machy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

RAILS AND RAIL JOINTS
*Easton Car & Constn. Co., New York.
*Koppel Indus. Car & Equip. Co., Koppel, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Sweet's Steel Co., Williamsport, Pa.

RAILROAD DITCHERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Byers Machine Co., J. F., Ravenna, O.
*Thew Shovel Co., Lorain, O.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Chicago, Ill.
Ball Engine Co., Erie, Pa.
Buckeye Traction Ditcher Co., Findlay, O.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Parsons Co., Newton, Ia.

RECORDERS, WATER STAGE
*Builders Iron Fdry., Providence, R. I.
Gurley, W. & L. E., Troy, N. Y.

REINFORCING CONCRETE. (See Concrete Reinforcements.)

RIVETERS, PNEUMATIC
Alliance Machine Co., Alliance, O.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Eng. Works, Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

RIVET SETS
Cleveland Pneumatic Tool Co., Cleveland, O.
Dunbar Drop Forge Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

RIVETS, BRIDGE AND STRUCTURAL. (See Bolts, Nuts, Etc.)

ROAD OILS. (See Oils, Road.)

ROAD OILERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Autocar Co., Ardmore, Pa.
*Connery & Co., Philadelphia, Pa.
*Good Roads Machinery Co., Philadelphia, Pa.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Littleford Bros., Cincinnati, Ohio.
*White Co., Cleveland, O.
Etnyre & Co., E. D., Oregon, Ill.
Four Wheel Drive Auto Co., Clintonville, Wis.
Huber Mfg. Co., Marion, O.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.
Universal Road Mchy. Co., Kingston, N. Y.

ROAD AND PAVING ROLLERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
Case Threshing Machine Co., J. I., Racine, Wis.
Erie Machine Shops, Erie, Pa.

ROAD AND STREET MACHINERY
*Acme Road Machinery Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Bay City Dredge Works, Bay City, Mich.
*Buffalo Springfield Roller Co, Springfield, O.
*Connery & Co., Inc., Philadelphia, Pa.
*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*Honhorst Co., Jos., Cincinnati, O.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Koppel Ind. Car & Equipment Co., Koppel, Pa.
*Littleford Bros., Cincinnati, O.
Adams & Co., J. D., Indianapolis, Ind.
Aultman & Taylor Mach. Co., Mansfield, Ohio.
Austin Machinery Corp'n, Chicago, Ill.
Avery Co., Peoria, Ill.
Erie Machine Shops, Erie, Pa.
Galion Iron Wks. & Mfg. Co., Galion, Ohio.
Haiss Mfg. Co., Geo., New York.
Lakewood Engineering Co., Cleveland, O.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Mfg. Co., Minneapolis, Minn.
Smith & Sons Mfg. Co., Kansas City, Mo.
Smith Co., T. L., Milwaukee, Wis.
United Iron Works, Kansas City, Mo.
Universal Road Mchy. Co., Kingston, N. Y.

ROCK CRUSHERS AND PULVERIZERS
*Acme Road Machinery Co., Frankfort, N. Y.
*Allis-Chalmers Mfg. Co. Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Machinery Co., Philadelphia, Pa.
*Weller Mfg. Co., Chicago, Ill.
Chalmers & Williams, Inc., Chicago Heights, Ill.
Fuller Lehigh Co., Fullerton, Pa.
Galion Iron Works Mfg. Co., Galion, O.
Guendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Co., Philadelphia, Pa.
McLanahan-Stone Mchy. Co., Hollidaysburg, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Road Machy. Co., Kingston, N. Y.
Williams Patent Crusher & Pulv. Co., Chicago, Ill.
Worthington Pump & Machy. Corp., New York.

ROCK DRILLS. (See Drills, Rock)

ROOFING, ASPHALT, COMPOSITION, TILE, ETC.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Carey Mfg. Co., Philip, Cincinnati, O.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Texas Co., New York.
American Cement Tile Mfg. Co., Pittsburgh, Pa.
Atlantic Refining Co., Philadelphia, Pa.
Bird & Son, E. Walpole, Mass.
Edwards Mfg. Co., Cincinnati, O.
Flintkote Co., Boston, Mass.
Johns-Manville, Inc., New York.
Keystone Roofing Mfg. Co., York, Pa.
Lehon Co., The, Chicago, Ill.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.
Sall Mountain Co., Chicago, Ill.
Sifo Products Co., St. Paul, Minn.
Sonneborn & Sons, Inc., L., New York.
Texas Co., New York.
United States Gypsum Co., Chicago, Ill.
Western Elaterite Roofing Co., Denver, Colo.

ROOFING, METAL
*Truscon Steel Co., Youngstown, O.
American Rolling Mill Co., Middletown, Ohio.
Berger Mfg. Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
National Metal Roofing Co., Jersey City, N. J.
United Alloy Steel Corpn., Canton, O.

ROOFING KETTLES. (See Kettles)

ROPE, MANILA
American Mfg. Co., Brooklyn, New York.
Columbian Rope Co., Auburn, N. Y.
Cupples Cordage Co., Brooklyn, N. Y.
Hooven & Allison Co., Xenia, O.
Kelly Co., R. A., Xenia, O.
New Bedford Cordage Co., New Bedford, Mass.
Peoria Cordage Co., Peoria, Ill.
Plymouth Cordage Co., N. Plymouth, Mass.
Wall Rope Wks., New York.
Waterbury Co., New York.
Whitlock Cordage Co., New York.

ROPE, WIRE, HOISTING, HAULAGE
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.
MacWhyte Co., Kenosha, Wis.
Moon Co., Geo. C., Garwood, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Williamsport, Pa.

RUBBER TIRES. (See Tires)

RULES, FOLDING
Kolesch & Co., N. Y. C.
Lufkin Rule Co., Saginaw, Mich.

SASH, ROLLED STEEL. (See Window Frames and Sash)

SAW RIGS, PORTABLE
*Knickerbocker Co., Jackson, Mich.
*Ransome Concrete Mach. Co., Dunnellen, N. J.

** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

WELLER MFG. CO.

1820-1856 N. Kostner Ave., Chicago, Ill.

DESIGNERS AND MANUFACTURERS OF

WELLER MADE CHICAGO

CONVEYING AND POWER TRANSMITTING MACHINERY

Apron Conveyors	Storage Plants	Screens
Belt Conveyors	Coal Crushers	Car Pullers
Drag Conveyors	Stone Crushers	Power Shovels
Chain Conveyors	Portable Elevators	Friction Clutches
Bucket Elevators	Portable Conveyors	Gears
Elevator Buckets	Chain	Sprocket Wheels

Instructive catalogues describing equipment—sent free on request. Be sure to mention equipment in which you are interested.

BRANCHES

New York, Boston, Baltimore, Pittsburgh, Salt Lake City, San Francisco

Economy

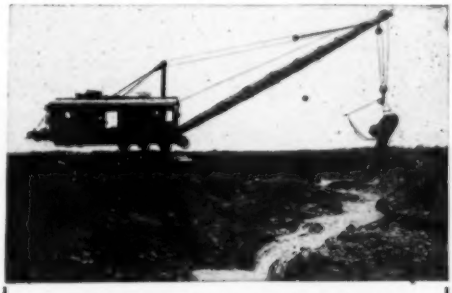
Time: One Thew ¼ yard shovel completed 1½ miles of road work in three weeks, handling 5381 cubic yards of slag macadam, rock and clay.

Operation: Another Thew in hard digging averaged 1100 lbs. of coal, 3 pints of cylinder oil and 3 tanks of water in a 9-hour day.

Maintenance: Still another Thew cost only $200.00 in repairs to complete 100,000 cubic yards of excavation in 9 months. Sixty percent was blasted rock. These not unusual Thew records have proved Thew Economy to the owners. Write for more proof.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

Thew Power Shovels



BUCYRUS DRAGLINE EXCAVATORS

Have won a reputation for dependability, low cost of operation, and steady output, the world over.

Railroad type and revolving shovels, dragline excavators, dredges, etc.

Send for Bulletin G-G. (379)

BUCYRUS COMPANY
South Milwaukee Wisconsin

*Standard Scale & Supply Co., Pittsburgh, Pa.
C. H. & E. Mfg. Co., Milwaukee Wis.
Oshkosh Mfg. Co., Oshkosh, Wis.

SCARIFIERS
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
Adams & Co., J. D., Indianapolis, Ind.
Galion Iron Works & Mfg. Co., Galion, O.
Huber Mfg. Co., Marion, O.
Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.
Russell Grader Co., Minneapolis, Minn.
Universal Road Mchy. Co., Kingston, N. Y.

SCRAPERS, ROAD
*Acme Road Machy. Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, O.
*Good Roads Machinery Co., Philadelphia, Pa.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
East Iron & Machine Co., Lima, O.
Galion Iron Works & Mfg. Co., Galion, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Root Spring Scraper Co., Kalamazoo, Mich.
Russell Grader Co., Minneapolis, Minn.
Sidney Steel Scraper Co., Sidney, O.
Western Wheeled Scraper Co., Aurora, Ill.

SCRAPERS, SELF-LOADING
*Baker Manufacturing Co., Springfield, Ill.
Smith & Sons Mfg. Co., Kansas City, Mo.

SCREENS, SAND, GRAVEL AND COAL
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Philadelphia, Pa.
*Littleford Bros., Cincinnati, O.
*Weller Mfg. Co., Chicago, Ill.
Atlas Eng. Co., Milwaukee, Wis.
Bartlett & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Gifford-Wood Co., Hudson, N. Y.
Haiss Mfg. Co., Geo., New York.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Philadelphia, Pa.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
New Jersey Wire Cloth Co., Trenton, N. J.
Robins Conv. Belt Co., N. Y. C.
Russell Grader Co., Minneapolis, Minn.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Wickwire Spencer Steel Corp., Worcester, Mass.

SCREENS, SEWAGE
Chain Belt Co., Milwaukee, Wis.
Pacific Flush Tank Co., Chicago, Ill.

SCREWS
American Screw Co., Providence, R. I.
Clark Bros. Bolt Co., Milldale, Conn.
St. Louis Screw Co., St. Louis, Mo.

SECOND-HAND EQUIPMENT
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Weiss, B. M., Philadelphia, Pa.

SEWAGE DISPOSAL APPARATUS
*Derr Co., The, New York City.
*Sanitation Corp., New York.
Pacific Flush Tank Co., Chicago, Ill.

SEWAGE PUMPS AND EJECTORS
*Otterson Auto Eductor Co., Springfield, O.
Erie Pump & Eng. Works, Medina, N. Y.
Pacific Flush Tank Co., Chicago, Ill.
Walworth Mfg. Co., Boston, Mass.
Yeomans Bros. Co., Chicago, Ill.

SEWER BLOCKS, SEGMENT
American Vit. Products Co., Akron, O.
Denver Sewer Pipe & Clay Co., Denver, Col.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
McNutt Meter Box Co., Brazil, Ind.
Red Wing Sewer Pipe Co., Red Wing, Minn.

SEWER CLEANING APPARATUS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Champion Corporation, Hammond, Ind.
Healey, P. J., New York.
Thompson-Fleming Co., Inc., Buffalo, N. Y.

SEWER PIPE AND DRAIN TILE
*Delaware Clay Products Co., Pittsburgh, Pa.
American Vit. Products Co., Akron, O.
Blackmer & Post Pipe Co., St. Louis, Mo.
Dee Co., Wm. E., Chicago, Ill.
Denver Sewer Pipe & Clay Co., Denver, Col.
National Fireproofing Co., Pittsburgh, Pa.
Robinson Clay Product Co., Akron, O.

SEWER RODS
*Turbine Sewer Machine Co., Milwaukee, Wis.
Bissell Co., F., Toledo, O.
Champion Corporation, Hammond, Ind.

SHOVELS, ELECTRIC
*Bucyrus Co., South Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
Marion Steam Shovel Co., Marion, O.

SHOVELS, GASOLINE
*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.

SHOVELS, HAND
American Shovel & Stamping Co., Lorain, O.
Ames Shovel & Tool Co., Boston, Mass.
Beall Bros. Co., Alton, Ill.
Chisholm Shovel Co., Cleveland, O.
Conneaut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Jackson Shovel Co., Montpelier, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Russell Shovel Co., Aliquippa, Pa.
Wood Shovel & Tool Co., Piqua, Ohio.
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS, STEAM
*Bucyrus Co., South Milwaukee, Wis.
*Byers Machine Co., J. F., Ravenna, O.
*Thew Shovel Co., Lorain, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Chicago, Ill.
Ball Engine Co., Erie, Pa.
Bellwood Steam Shovel Co., Bellwood, Pa.
Browning Co., Cleveland, O.
Fairbanks Steam Shovel Co., Marion, O.
Industrial Works, Bay City, Mich.
Keystone Driller Co., Beaver Falls, Pa.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Smith Co., T. L., Milwaukee, Wis.

SIGNS, STREET AND ROAD
Baltimore Enamel & Novelty Co., Baltimore, Md.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
N. Y. Enameled Steel Sign Co., New York.
Safety Equipment Service Co., Cleveland, O.
Thompson-Fleming Co., Inc., Buffalo, N. Y.
Union Iron Products Co., East Chicago, Ind.

SLATE, ROOFING
Vendor Slate Co., Inc., Easton, Pa.

SLATE, STRUCTURAL
Penna. Structural Slate Co., Easton, Pa.
Phœnix Slate Co., Windgap, Pa.
Structural Slate Co., Pen Argyl, Pa.

SLEEVES, TAPPING AND VALVE
*Mueller Mfg. Co., Decatur, Ill.
*Rensselaer Valve Co., Troy, N. Y.
*Smith Mfg. Co., A. P., East Orange, N. J.

SLUICE GATES. (See Gates, Sluice.)

SMOKE STACKS. (See Stacks, Steel)

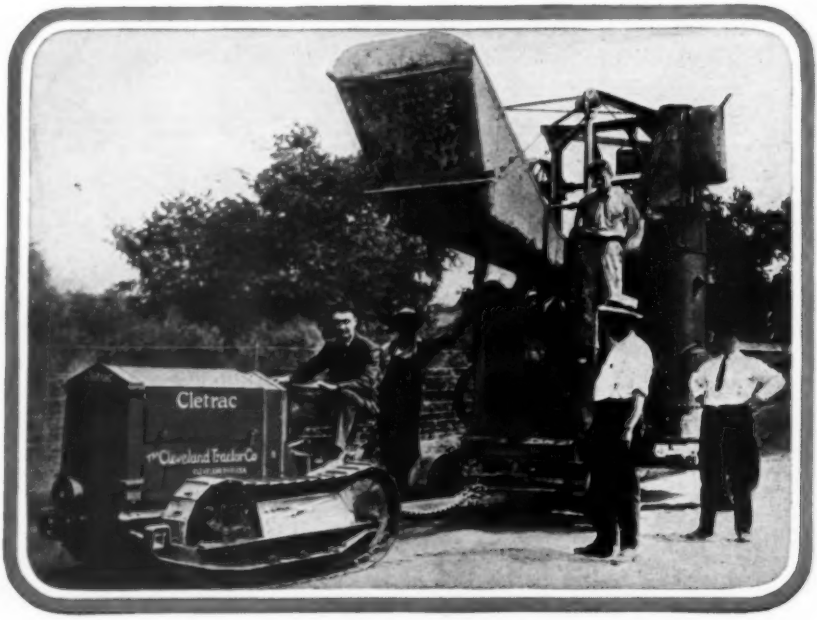
SNOW CLEANING MACHINERY
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Cleveland Tractor Co., Cleveland, O.
*Good Roads Machinery Co., Philadelphia, Pa.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
Barber-Greene Co., Aurora, Ill.
Toy Co., W. M., Sidney, Ohio.
J. T. Tractor Co., Cleveland, O.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

SPREADERS, STONE
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.

STACKS, STEEL
*Connery & Co., Inc., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS. (See Shovels, Steam)

STANDPIPES, TANKS AND TOWERS
*Connery & Co., Inc., Philadelphia, Pa.



Cletrac
TANK-TYPE TRACTOR

Versatility is Cletrac's Long Suit

CLETRAC'S exceptional versatility, economy and endurance make it the first choice of contractors. It's always ready to speed the building or paving of streets, digging of ditches, or any other heavy duty job. Cletrac does the work of at least three teams, in the space required for one. It doesn't have to be fed when idle, needs little care, and saves the wages of several drivers.

HARD THIS WAY. BUT—

EASY ON A TRACK THE CLETRAC WAY

Weather doesn't bother Cletrac—it steps right along in snow or sunshine. Its two tank-type tracks keep it up out of the mud. And it digs in with its "toe nails" on hard or slippery surfaces. There's never any miring or slipping.

See the Cletrac dealer near you—or write direct to us—and learn how Cletrac will cut costs on every operation.

For specifications and complete description, see Sweet's Engineering Catalog.

THE CLEVELAND TRACTOR CO.

Largest Producers of Tank-Type Tractors in the World

19211 Euclid Ave. **Cleveland, Ohio**

*Fairbanks, Morse & Co., Chicago, Ill.
*Pacific Tank & Pipe Co., San Francisco, Cal.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Eagle Tank Co., Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM TURBINES
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co., New York.

STEEL PLATE CONSTRUCTION
*Connery & Co., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Bethlehem Steel Bridge Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Steel Corp., Birmingham, Ala.
Blaw-Knox Co., Pittsburgh, Pa.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Heltzel Steel Form & Iron Co., Warren, O.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STOKERS, MECHANICAL
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Babcock & Wilcox Co., N. Y. C.

STREET AND ROAD SIGNS. (See Signs, Street and Road.)

STREET CLEANERS' CARTS
*Rochester Can Co., Rochester, N. Y.
*Tarrant Mfg. Co., Saratoga Springs, N. Y.
Durlach Can & Iron Works, Brooklyn, N. Y.

STREET FLUSHERS AND SPRINKLERS
*Austin-Western Road Machy. Co., Chicago, Ill.
*Autocar Co., Ardmore, Pa.
*International Motor Co., New York.
*Municipal Supply Co., South Bend, Ind.
*Tiffin Wagon Co., Tiffin, O.
*White Co., Cleveland, O.
Etnyre & Co., E. D., Oregon, Ill.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Service Motor Truck Co., Wabash, Ind.

STREET LAMP POSTS
*Electric Railway Equipment Co., Cincinnati, O.
*General Elec. Co., Schenectady, N. Y.
*King Mfg. Co., Chicago, Ill.
*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
*Union Metal Mfg. Co., Canton, O.

STREET SWEEPERS
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Elgin Sales Corp'n., New York.
*Good Roads Machinery Co., Philadelphia, Pa.
*Rochester Can Co., Rochester, N. Y.
*Tiffin Wagon Co., Tiffin, O.
Universal Road Mchy. Co., Kingston, N. Y.

STRUCTURAL STEEL AND IRON. (See Bridges and Buildings)

STUMP PULLERS
Bennett & Co., H. L., Westerville, O.
Carpenter & Co., Geo. B., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Lewis & Valentine, Roslyn, L. I.
Thomas Elevator Co., Chicago, Ill.

SURVEYORS' INSTRUMENTS. (See Instruments.)

TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES
*Pawling & Harnishfeger Co., Milwaukee, Wis.
Construction Mach'y Co., Waterloo, Ia.

TANKS, AIR COMPRESSOR
*Connery & Co., Inc., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Indiana Air Pump Co., Indianapolis, Ind.
*Littleford Bros., Cincinnati, O.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Abendroth & Root Mfg. Co., New York.
Biggs Boiler Wks., Akron, O.
Chicago Bridge & Iron Works, Chicago, Ill.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS FOR OIL
*Connery & Co., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
*Pacific Tank & Pipe Co., San Francisco, Cal.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Biggs Boiler Works Co., Akron, O.
Bowser & Co., S. F., Fort Wayne, Ind.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Dover Boiler Works, New York.
Fouts Co., C. C., Middletown, O.
Petroleum Iron Works Co., Sharon, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
United Iron Works, Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

TANKS, STEEL
*Connery & Co., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Honhorst Co., Jos., Cincinnati, Ohio.
*Littleford Bros., Cincinnati, O.
*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Biggs Boiler Wks., Akron, O.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Hardesty Mfg. Co., R., Denver, Col.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.

TANKS, WOOD
*Pacific Tank & Pipe Co., San Francisco, Cal.
Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Redwood Manufacturers Co., San Francisco, Calif.
Scaife & Sons, Wm. B., Oakmont, Pa.
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS
*Acme Road Mach. Co., Frankfort, N. Y.
*International Motor Co., New York.

TAPES, STEEL AND METALLIC
Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Kolesch & Co., New York.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Athol, Mass.

TAR
*Barrett Co., New York.

TAR KETTLES. (See Kettles)

TIES, STEEL
*Koppel Industrial Car & Equip. Co., Koppel, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIRES, RUBBER. (For Motor Trucks.)
*Kelly Springfield Tire Co., New York.
Firestone Tire & Rubber Co., Akron, O.
Goodrich Rubber Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Republic Rubber Co., Youngstown, O.
U. S. Tire Co., New York.

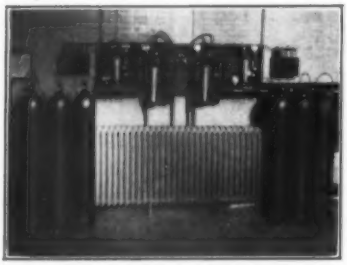
TOOL HOUSES, PORTABLE STEEL
*Littleford Bros., Cincinnati, O.

TOWERS (See Standpipe Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE
*Easton Car & Constn. Co., New York.
*Koppel Ind. Car & Equipment Co., Koppel, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
Hunt Co., Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.
Light Railway Equipment Co., Philadelphia, Pa.

TRACTORS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Cleveland Tractor Co., Cleveland, O.

What Does W & T Service Mean to 1996 Communities in the United States?



Minneapolis is of the 1996 Communities in the United States using W & T Chlorinators

It means that they are using W & T Chlorinators to protect their water supplies by the application of Liquid Chlorine –the 100% sterilizing agent.

It means that they are therefore absolutely protected against water-borne disease.

It means that each year they are tending to reduce their typhoid fever death rates to unbelievably low figures.

It means that for one cent per capita per year they are insuring the safety of their water supply.

And it means that they have a nation-wide organization of trained men constantly at their call for anything relating to the sterilization of water or the disinfecting of sewage.

Wallace & Tiernan Co., Inc.

Manufacturers of W & T Chlorine Control Apparatus for swimming pool sterilization and W & T Equipment for paper and textile bleaching Also the Booth Dry Feeder for the application of pulverized chemicals

Newark, New Jersey

Chicago Atlanta San Francisco Pittsburgh
Dallas Kansas City Toronto, Canada

*Dayton-Dowd Co., Quincy, Ill.
*Fairbanks, Morse & Co., Chicago, Ill.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
*White Company, The, Cleveland, O.
Advance-Rumely Thresher Co., Laporte, Ind.
Avery Co., Peoria, Ill.
Barrett-Cravens Co., Chicago, Ill.
Bates Machine & Tractor Co., Joliet, Ill.
Best Tractor Co., C. L., San Leandro, Cal.
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tructractor Co., Chicago, Ill.
Dart Truck & Tractor Corp., Waterloo, Ia.
Four Wheel Drive Auto Co., Clintonville, Wis.
Hart-Parr Co., Charles City, Iowa.
Huber Mfg. Co., Marion, O.
J. T. Tractor Co., Cleveland, O.
Oliver Tractor Co., Knoxville, Tenn.
Selden Truck Corp'n., Co., Wabash, Ind.
Service Motor Truck Co., Wabash, Ind.
Watson Products Corp., Canastota, N. Y.

TRAILERS FOR MOTOR TRUCKS
Arcadia Trailer Corp., Newark, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
Lee Trailer & Body Co., Chicago, Ill.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n., Canastota, N. Y.

TRAILERS, INDUSTRIAL
Chase Fdry. & Supply Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Kuhlman Electric Co., Bay City, Mich.

TRANSITS AND LEVELS. (See Instruments.)

TRANSMISSION MACHINERY, POWER
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, N. Y.
*Weller Mfg. Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Link Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

TRASH CANS. (See Cans)

TREADS, SAFETY
American Abrasive Metals Co., New York.
American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Irving Iron Works, Long Island City.

TRENCH BRACES. (See Braces, Trench)

TRENCH EXCAVATORS, (see Excavators, Ditch & Trench)

TRENCH PUMPS. (See Pumps, Contractors')

TURBINES
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*General Electric Co., Schenectady, N. Y.
*Westinghouse Elec. & Mfg. Co., E Pittsburgh, Pa.
De Laval Steam Turbine Co., Trenton, N. J.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.

USED MACHINERY
*Craven Co., Frank T., New York.
*Curtiss-Willis Co., New York.
*Weiss, B. M., Philadelphia, Pa.

VALVE CONTROL APPARATUS, ELECTRIC
*Payne Dean Ltd., New York.

VALVES, GATE AND INDICATOR POSTS
*Crane Company, Chicago, Ill.
*Norwood Engineering Co., Florence, Mass.
*Smith Mfg. Co., A. P., East Orange, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

VALVE BOXES AND HOUSINGS
*Central Foundry Co., New York.
*Mueller Mfg. Co., H., Decatur, Ill.
*Smith Mfg. Co., A. P., East Orange, N. J.
*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Co., Troy, N. Y.
Pratt & Cady Co., Inc., Hartford, Conn.
Rensselaer Valve Co., Troy, N. Y.
S. E. T. Valve & Hydrant Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS. (See Dump Carts and Wagons.)

WAGON BODIES. (See Dump Bodies)

WAGON LOADERS. (See Loaders, Gravel and Wagon)

WALLBOARD
*Carey Co., Philip, Cincinnati, Ohio.
Beaver Board Companies, Buffalo, N. Y.
Bird & Son E. Walpole, Mass.
Cornell Wood Products Co., Chicago, Ill.
Haverhill Box Board Co., Haverhill, Mass.
MacAndrews & Forbes Co., New York, N. Y.
Plastergon Wall Board Co., Buffalo, N. Y.
United States Gypsum Co., Chicago, Ill.
Upson Co., The, Lockport, N. Y.
Waldorf Paper Products Co., St. Paul, Minn.

WALL TIES
Concrete Steel Co., New York. N. Y.
Consolidated Expanded Metal Co., Braddock, Pa.
Berger Mfg. Co., Canton, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

WATER MAIN CLEANING
*National Water Main Cleaning Co., New York.

WATER MAIN TAPPING MACHINES
*Mueller Mfg. Co., H., Decatur, Ill.
*Smith Mfg. Co., A. P., E. Orange, N. J.

WATER METERS. (See Meters, Water and Oil.)

WATERPROOFING COMPOUNDS AND MATERIAL
*Barber Asphalt Paving Co., Philadelphia, Pa.
*Barrett Company, New York.
*Carey Company, Philip, Cincinnati, O.
*Standard Oil Co. of Indiana, Chicago, Ill.
*Truscon Laboratories, Detroit, Mich.
Anti-Hydro Waterproofing Co., New York.
Atlantic Refining Co., Philadelphia, Pa.
General Fireproofing Co., Youngstown, O.
Granitex Corp., New York.
Horn Co., A. C., Long Island City, N. Y.
Master Builders' Co., Cleveland, O.
Minwax Co., The, New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Sonneborn Sons, Inc., New York.
Texas Company, New York.
Toch Brothers, New York.

WATER PURIFICATION
*Electro Bleaching Gas Co., New York.
*Mathieson Alkali Works, Inc., New York.
*Penna. Salt Mfg. Co., Philadelphia, Pa.
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
*Wallace & Tiernan Co., Inc., Newark, N. J.
Clow & Sons, J. B., Chicago, Ill.
N. Y. Continental Jewell Filter. Co., Nutley, N.J.
Norwood Eng. Co., Florence, Mass.
Permutit Co., New York.
R. U. V. Company, New York.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.

CLEAN YOUR WATER MAINS

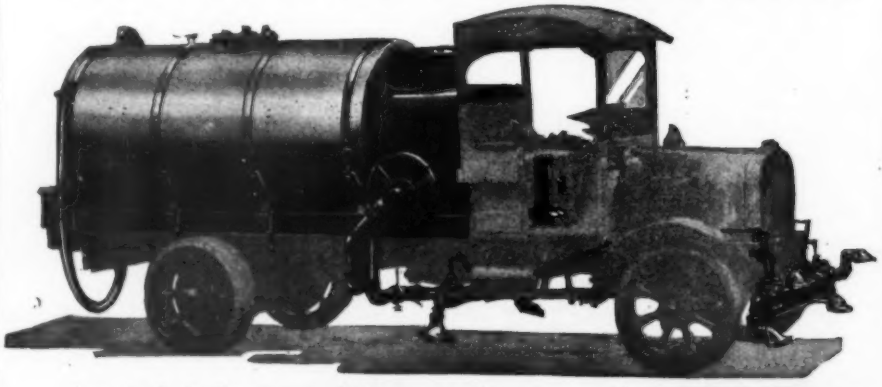
One does not have to be an expert mathematician to figure out that a clogged water main calls for a stronger pressure and that in turn calls for more coal —and literally burning up money. We can show you how to get dollar for dollar value out of every ton of coal. We can show you how to clean the water mains quickly and cheaply. Send us your address—that's all we ask of you.

National Water Main Cleaning Co.

Hudson Terminal Building

NEW YORK CITY

"STUDEBAKER MODEL" FLUSHING UNIT WITH SPRINKLING ATTACHMENT



Any truck dealer or manufacturer can give you information on a complete outfit.

We will send catalog and data to all interested.

MUNICIPAL SUPPLY COMPANY

STREET FLUSHING AND SPRINKLING EQUIPMENT

SOUTH BEND, INDIANA

STREETS KEPT CLEAN

WATER REGULATORS
*Mueller Mfg. Co., Decatur, Ill.
*Union Water Meter Co., Worcester, Mass.
Pacific Flush Tank Co., Chicago, Ill.

WATER SOFTENERS
*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.
American Water Softener Co., Philadelphia, Pa.
Borromite Co., Chicago, Ill.
International Filter Co., Chicago, Ill.
N. Y. Continental Jewell Filtr. Co., Nutley, N. J.
Permutit Company, New York.
Refinite Co., Omaha, Neb.
Roberts Filter Mfg. Co., Darby, Pa.
Scaife & Sons, W. B., Pittsburgh, Pa.

WATER WHEELS
*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Leffel & Co., Jas., Springfield, O.
Pelton Water Wheel Co., San Francisco, Cal.
Smith Company, S. Morgan, York, Pa.

WELDING APPARATUS
*General Electric Co., Schenectady, N. Y.
Milburn Company, Alex., Baltimore, Md.
Oxweld Acetylene Co., Newark, N. J.

WELL SCREENS
*Johnson, Edw. E., Inc., St. Paul, Minn.

WELL-DRILLING AND BLAST HOLE MACHINES
*American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Iowa.
Keystone Driller Co., Beaver Falls, Pa.
Leidecker Tool Co., Marietta, Ohio.
Loomis Machine Co., Tiffin, O.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Sparta Iron Wks. Co., Sparta, Wis.
Star Drilling Machine Co., Akron, O.

WHEELBARROWS
Akron Cultivator & Mfg. Co., Akron, O.
Jackson Mfg. Co., Harrisburg, Pa.
Kilbourne & Jacobs Mfg. Co., Columbus, O.
Lansing Co., Lansing, Mich.
Sidney Steel Scraper Co., Sidney, O.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Stuebner Iron Wks., G. L., Long Island City, N. Y.
Toledo Wheelbarrow Co., Toledo, O.

WINDOW FRAMES AND SASH. (Metallic.)
International Steel & Iron Co., Evansville, Ind.
Lupton's Sons Co., David, Philadelphia, Pa.

WIRE AND CABLE
*General Electric Co., Schenectady, N. Y.
*Simplex Wire & Cable Co., Boston, Mass.
American Steel & Wire Co., Chicago, Ill.
Habirshaw Elec. Cable Co., Inc., N. Y. C.
Hazard Mfg. Co., Wilkesbarre, Pa.
Macwhyte Co., Kenosha, Wis.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York.
Okonite Co., New York.
Roebling's Sons Co., J. A., Trenton, N. J.
Safety Ins. Wire & Cable Co., New York.
Standard Underground Cable Co., New York.
Tubular Woven Fabric Co., Pawtucket, R. I.
Waterbury Co., New York.

WIRE GLASS
Mississippi Wire Glass Co., New York.

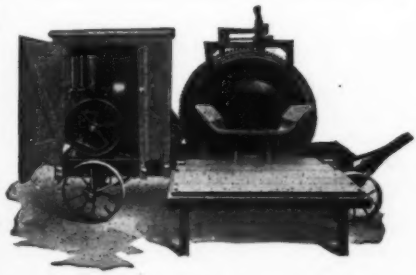
WIRE MESH REINFORCEMENT
*American Steel & Wire Co., Chicago, Ill.
*National Steel Fabric Co., Pittsburgh, Pa.
Wickwire Spencer Steel Corp., Worcester, Mass.

WIRE ROPE. (See Rope, Wire.)

WOODWORKING MACHINES
*Fairbanks-Morse & Co., Chicago, Ill.
*Ransome Concrete Mach. Co., Dunellen, N. J.

WOOD PRESERVATIVES
*Barrett Company, New York.
*Truscon Laboratories, Detroit, Mich.
General Chemical Co., New York.
Protexol Corpn., New York.
Republic Creosoting Co., Indianapolis, Ind.

WRENCHES
Erie Tool Works, Erie, Pa.
Greene, Tweed & Co., New York.
Lowell Wrench Co., Worcester, Mass.



"THE STANDARD" LINE OF
Contractors' Equipment

Concrete Mixers, Street Pavers, Hoists, Pumps, Gas, Gasoline and Oil Engines, Material Elevators, Spouting Equipment, Wheelbarrows, etc. Also wagon and motor truck scales. Send for Catalogue No. 69.

THE STANDARD SCALE AND SUPPLY COMPANY
1631 Liberty Avenue, Pittsburgh, Pa.
New York Philadelphia Baltimore Cleveland Chicago Detroit Dallas

SEWER PIPE

CULVERT PIPE—
WALL COPING—
FLUE LINING—
STOVE PIPE—

HOLLOW BUILDING TILE—DRAIN TILE—FIRE CLAY —ETC. :: :: ::

Prompt Deliveries
THE DELAWARE CLAY PRODUCTS CO.
807 WESTINGHOUSE BLDG., PITTSBURGH, PA.
Write for Information

"Yes, we mix all our mortar by machine now —the RANSOME BANTAM"

"Time was"—said the masonry contractor—"when we wouldn't have dreamed of using machine-mixed mortar. Thorough mixing is the life of good mortar, of course, and we were pretty doubtful that any machine could do the job right—especially the small mixers such as one wants for this sort of work.

"But this new RANSOME 'BANTAM' certainly opened our eyes. In my opinion, and that of my men, and of the Inspectors, the quality of the mortar this machine turns out is fully up to hand-mixed standards—and our mixing costs have fallen 'way off. The machine is simple, light, easy to operate and move about, and not only turns out the mortar thoroughly well mixed, but does it amazingly fast. The purchase of a RANSOME 'BANTAM' MIXER calls for only a small investment, but we consider ours one of the best such investments we ever made."

Ransome Bulletin No. 108 explains the details of the new RANSOME "BANTAM" MIXER design and construction which enable this mixer to so extensively replace hand methods of mortar mixing in the service of conservative builders. Write for special data.

Ransome Bantam Type CONCRETE MIXERS

RANSOME CONCRETE MACHINERY CO.

1772 Second Street, Dunellen, N. J.

Manufacturers of Mixers, Pavers, Pneumatic Mixers, Charging Plants, Hoist Buckets, Bins, Cars, Carts, Etc.

31-2

EDGAR J. BUTTENHEIM, President | HERBERT K. SAXE, Treasurer | L. P. ANDERSON, Secretary | THEO. R. KENDALL, General Manager | ARTHUR FREUND, Advertising Manager

CONTRACTORS' & ENGINEERS' MONTHLY

A PURCHASING GUIDE FOR ENGINEERS, CONTRACTORS, PUBLIC OFFICIALS AND OTHER PURCHASERS OF CONSTRUCTION MATERIALS AND EQUIPMENT

Published Monthly at 154 Nassau St., New York, by The Civic Press, Inc.
25 Cents a Copy. $1.00 a Year

Branch Offices Chicago, Ill., 327 So. LaSalle Street. Tom Dix, Vice-President
San Francisco, 320 Market Street. W. A. Douglass, Pacific Coast Representative

Vol. III | CONTENTS FOR OCTOBER, 1921 | No. 4

EDITORIAL

Economical Brick Building Construction 41
The Cost of Repairing Bituminous Pavements 43
Pneumatic Chipping Tool Used to Trim High Concrete Joints 44
Clam-Shell Buckets for Excavating, Rehandling and Dredging 45
A Complete Portable Asphalt Plant 47
The Manufacture and Use of Corrugated Iron Culverts 48
Building Concrete Foundations with Standard Steel Plate Forms 49
The Use of Calcium Chloride on Roads 50
Labor Unions Would Eliminate the Contractor 51
Ornamental Metal Columns in Building Construction and Remodeling 52
Stucco in Building Construction 53
A Concrete Column Form Clamp 55
Spotting Building Material Deliveries 56
Open-Shop Arguments 56
Concrete Highway Bridge and Culvert Standards—Part I 57
Walk on the Left Side 60
Literature Worth Looking Over 61
Contractors', Engineers' and Manufacturers' Notes 63
Motor Contracting Equipment 64
Legal Decisions in the Contracting Field 66
Modern Practice in Paving Joints 67
Trailers Turn Hauling Job from Loss to Profit 68
The Manufacture and Laying of Concrete Pipe 69
Saving the Roads 71
State Highway Department Adopts Progress Chart as Part of Contract 72
Safety First Signs Prevent Accidents 73
Investment in Engineering Lasts Forever 73
Wetness versus Fatness 74
How They Succeed 76
A Complete Rock-crushing and Screening Plant 78
Tunnel Liner Plates for Sewer Construction 80
Wages Here and Abroad 80

Breaking New York State Road Construction Records

W. J. Porter lays 900 feet of reinforced concrete road in a 10-hour day with nine Autocars. Also saves $18,000 in overhead expense.

No. 1. The start at the central hopper, where Autocar takes on two batches of stone and sand in 15 seconds.

No. 2. Autocar at freight car, where six bags of cement are poured onto each batch.

No. 3. Autocar dumping first batch of 25 cubic feet in the skip of the mixer.

No. 4. Skip rises and pours first batch into mixer. Autocar has moved forward a few feet.

MR. W. J. PORTER is very much on the job on the road contract which he has at Eastport, L. I. With nine Autocars hauling all of the material, he has made a record of 900 feet of 20-foot reinforced concrete road in a 10-hour day. He has completed the first four miles of this nine-mile contract in 32 working days, with an average round-trip haul of three miles.

He figures that his overhead charges on this job amount to $300 a day whether he works or not. At his present rate of progress he will easily cut off 60 days from the time that would be required to complete this contract at the average rate of road construction in New York State. Here is a saving of $18,000 in overhead.

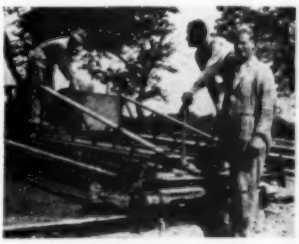
Mr. Porter is convinced that Autocars are the only trucks the contractor should consider for road construction, and he is enthusiastic over the flexibility of his fleet of 2-ton Autocars.

Mr. Porter has given close thought to every detail. He keeps the approach to his loading hopper constantly oiled to facilitate the burden of his trucks, and has perfected a loading device which drops to measure the batches of dry aggregate into each Autocar truck in 15 seconds.

In order to centralize his supply of sand and stone, he constructed a 700-foot spur track with switches capable of handling 12 freight cars of stone at one time. By means of this track he is able to empty the cars of stone with the same crane which lifts the sand out of the ground and into the loading hopper.

Under his contract, Mr. Porter has until August, 1922, to finish this job. He will finish it this season.

No. 5. Skip has dropped and Autocar has returned and is dumping the second batch.



No. 6. Automatic finisher, which follows immediately behind the mixer to ramp and smooth the concrete.

No. 7. The last touches are applied by hand.

Mr. W. J. Porter, who has reduced the time on this job to 30 minutes for the complete round trip of three miles.

Contractors' & Engineers' Monthly

Vol. III, No. 4 New York, N. Y. October, 1921

Economical Brick Building Construction

By Ralph P. Stoddard

Secretary-Manager, The Common Brick Manufacturers' Association, Cleveland, Ohio

BRICK masons throughout the country are startled by the announcement which has gone out in the past few months, that a good-looking, substantial brick house can be built at the cost of frame. The brick manufacturer and the brick contractor, as well as the mechanic, who have depended upon the popularity of brickwork for their living, have always faced the serious handicap of a widespread miscalculation as to the difference in cost between brick and frame.

The word frame is not used here in the sense of reflecting in any way upon that type of construction or for drawing comparisons which might be unpleasant to anyone. The term is used simply because in a country where 85 per cent of all residence construction is frame, it is by comparison with that type of building that the relative cost of any other type may be most easily understood by the average person.

The advantages of brick as a building material have been quite generally known—although until recently the brick manufacturer himself has not done much to spread this information—but the person who desired to build himself a home of brick always found himself meeting with an argument which came from the back of his brain somewhere—"Brick is too expensive." If you asked a man where he got that impression he probably could not put his finger on the source of information, but at one time nearly everybody believed that a brick house cost 25 or 50 per cent, or possibly 100 per cent, more than a house of wood. The matter was allowed to go on in this way for such a long time that the brick men now find it difficult to change this opinion regardless of how many facts they may present.

The actual truth of the matter is that never during the history of brick-making in this country has there been an actual

BUILT IN 1880 AT ARHULTEMALA, SWEDEN, THIS IDEAL WALL BUNGALOW (PLASTERED DIRECTLY ON THE BRICK) HAS PROVED COMFORTABLE THROUGHOUT THE YEAR IN THAT NORTHERN CLIMATE

DETAIL OF CONSTRUCTION OF ALL-ROLOCK WALL, WITH ITS 2¼-INCH WEBS AND VENTILATED AIR SPACE

first-cost difference between brick and frame of more than 6 to 12 per cent, varying with the design of house and local current prices. Generally throughout the country to-day a house that would be built for $6,500 in frame, would be built for $6,800 with 8-inch exterior walls of brick. In cities where the building codes have wastefully demanded a 13-inch wall for residences, the difference between brick and frame has been widened, naturally to the discouragement of the former. To-day a wave of common sense regarding building regularities is sweeping the country, and the 8-inch brick wall, it is believed, will soon become general for residence requirements.

Brick Hollow Walls

Now comes the startling announcement that a new way to lay brick still further reduces the cost—even below that of the 8-inch solid wall. While this type of construction is being promoted for the first time, it cannot be truthfully said to be new. Masons here and there throughout this country and Europe have built a job or two with the brick set on edge. Early in the present year the Common Brick Manufacturers' Association of America began the careful working out of the details of this system of laying brick and of testing walls thus built, and are now aggressively recommending what they call Ideal brick hollow walls as the best type of side wall for all residences and other small buildings.

The Brick Association has published details of 8- and 12-inch all-rolock wall and of 8- and 12-inch rolock-back wall. As the name implies, the all-rolock is produced with all the brick on edge, while in the other type of wall the brick in the face of the wall are laid flat in the usual manner, with the back-up brick laid on edge and bonded at every third or sixth course. The 8-inch all-rolock wall is the one most commonly in use. The Association has a recommendation of more than one hundred communities in the United States in which this type of wall is in daily use for home and garage building. It takes one-third less brick, one-half the mortar and 25 per cent less labor than the 8-inch solid wall. It has the further economy of being an absolutely dry wall when plastered directly on the brick, doing away with furring and lathing. These savings actually cut the cost of Ideal wall more than one-third below that of a solid wall of equal thickness. This claim is being proved in actual practice in all parts of the country.

With few exceptions bricklayers have recognized the possibility of this construction and have entered upon the erecting of Ideal wall in a spirit to prove its possibilities. In one or two cases the bricklayer has taken the narrow view that anything which reduces the quantity of brick in a wall will take bread and butter away from him. These bricklayers have tried to discourage the wall by absurdly low production. Out of hundreds of jobs reported through the Association, however, in only

two cases have the bricklayers taken this attitude. There are many jobs on which the production averaged 1,200 to 1,300 brick per man for an 8-hour day. In a few cases even this number has been exceeded. Bricklayers who have never seen the wall before invariably maintain an average of 1,000 brick a day right from the start. These men believe that anything that reduces the cost of a brick house will cause two or three brick houses to be built where one was built before. They join with the brick manufacturer in calling the Ideal wall the greatest boon that has come into the industry in many years.

An Established Success

Since the Association began giving publicity to this type it has heard from various parts of the world where single operations in this construction have gone up. Each of these has been carefully investigated, and without exception the houses have proved dry and comfortable in all seasons when plastered directly on the brick. The walls have been as substantial and durable as solid walls, and in no case has there been any complaint whatever of this type of building. In varjous places contractors who have never before built brick homes have been attracted to this type of construction, and give testimony of the ease with which the Ideal houses are sold and of the satisfaction felt by the purchasers. From the enormous prestige gained during the few months that Ideal wall has been promoted, and from its eager acceptance by architects and practical builders, the Brick Association predicts that brick hollow wall will go far towards revolutionizing home building construction in America. There are so many arguments in favor of the permanent fire-safe type of home that when it is generally understood that a home of this kind costs no more than an inflammable type, the changed sentiment towards permanent construction will be great.

The Cost of Repairing Bituminous Pavements

Data from Albany, N. Y., Show a Not Unreasonable Increase

THE first sheet asphalt pavement in Albany, N. Y., was laid in 1889, and since that time there has been laid over 336,000 square yards, of which about 190,000 square yards, or more than one-half, has been laid since 1914. There was no asphaltic concrete pavement laid in the city previous to 1914, but since that time about 38,000 square yards has been laid. The city has laid no bitulithic pavement, but there are about 24,000 square yards within the city limits, laid by the State Highway Commission. Thus there is about 400,000 square yards of bituminous pavement in Albany, and the tendency is to use more asphalt from year to year in paving residential and light traffic streets where the grades will permit.

With this large yardage, equivalent to about 22½ square miles of pavement 30 feet wide, repairs are necessary, and as the pavements become older, more and more repairs are necessary to properly maintain them. The Department of Public Works has had the asphalt repair work done by contract because the city has no facilities for doing the work itself. The prices per square yard for repairing the asphalt pavements have been increasing year by year, as follows:

1915	$1.23½
1916	1.63
1917	2.10
1918	2.10
1919	2.20
1920	2.60

Considering the cost and difficulty of securing labor and materials in the last few years, these prices have not been unreasonable. The price per square yard includes cutting out and removing the old asphalt, cleaning the space to be repaired or renewed, and furnishing and placing the new binder and the new asphalt wearing surface. If any part of the concrete foundation has to be renewed, this is paid for at a fixed price per cubic yard.

Pneumatic Chipping Tool Used to Trim High Concrete at Joints

IT costs the contractor considerably less money to have the finishing of the concrete pavement accurately done at the time of the placing than to correct errors in finish after the concrete has hardened. Any unevenness is readily detected in driving over the pavement and produces an undesirable effect. Heavy traffic sets up an unusually heavy impact at such a place, with corresponding tendency to injure the pavement.

N. Y., upon opening the pavement to traffic, the concrete at several joints was found to be high.

The contractor secured a compressed air outfit, attached it to a pneumatic chipping chisel, similar to those used in stone cutting, and immediately started a man at cutting down the excess concrete alongside the joints. Testing the longitudinal grade frequently, by a straight-edge, the operator was able in brief time to remove this excess.

TO CORRECT IRREGULARITIES IN CONCRETE PAVEMENTS DUE TO UNEVEN JOINTS A PNEUMATIC CHIPPING TOOL WAS USED EFFECTIVELY IN ERIE COUNTY, PENNSYLVANIA

Correcting a depression or leveling off a slight ridge is often laborious and costly. It sometimes happens, however, that such irregularities in surface exist in spite of rigid inspection and close watching by the contractor's foreman. It is perhaps more difficult to keep out of this condition in finishing on each side of a joint than at any other place.

On Route 87, Erie County, Pa., the concrete road between Erie, Pa., and Buffalo,

The outfit used was:

1 compressed air outfit
1 chipping chisel, pneumatic
1 team
2 laborers

Doubtless the contractor's profits were reduced by having to do this work, and would have been saved by more rigid attention to the finishing during construction, but under the circumstances the cost of remedying the error was kept at a minimum.

Who Makes Contractors' Hoists?

When confronted by a question like this consult the "Where to Purchase" directory, beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY.

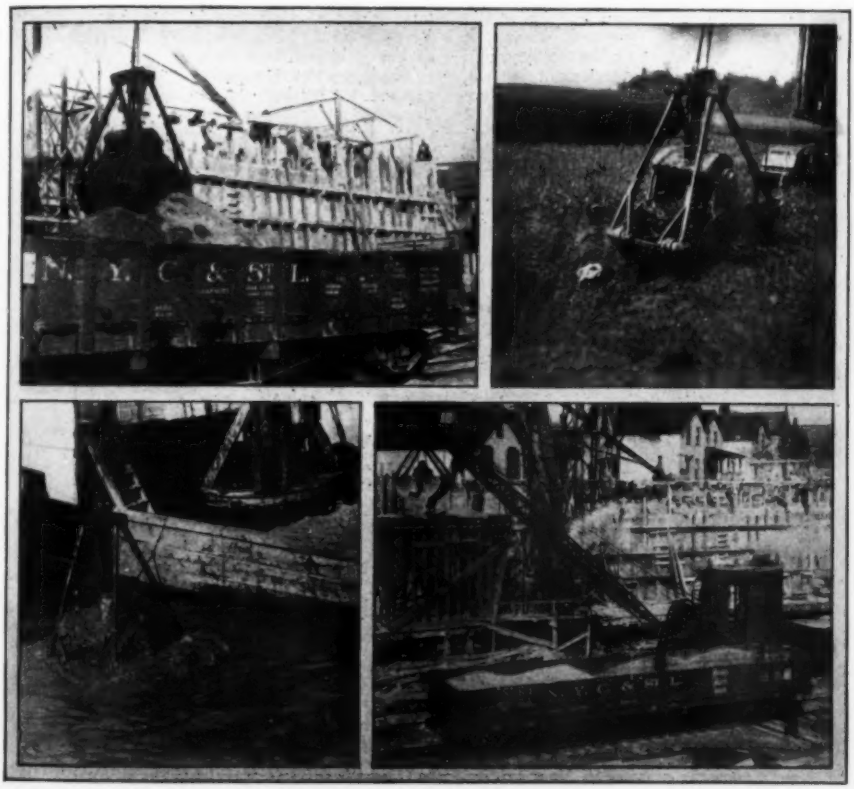
Clam-Shell Buckets for Excavating, Rehandling and Dredging

THE "grab" bucket meets its severest test of digging ability in excavating when it is called upon the fill itself with various materials in their natural formation, which in most cases is in a hard, compact state. A bucket which meets this requirement will give excellent satisfaction when used for all other material-handling purposes.

The Owen Bucket Company, 418 Kirby Building, Cleveland, Ohio, manufactures clam-shell buckets which are primarily constructed and designed to give satisfaction on the hardest digging propositions. It is claimed that they will dig harder material and more of it under all conditions and at a smaller operating cost than any other type of grab bucket. The exceptional digging ability of Owen buckets is due to the distribution of weight throughout their construction, to a great and undiminished closing power which utilizes this weight at every point of the digging, and to its shell shape and its construction which causes it to cleave instead of scrape its way through the material. This third feature of construction is essential in an excavating bucket, as a grab of hard and compact material should not be scraped together, but must be penetrated by the jaws of the bucket in order to make sure of any degree of efficiency when excavating.

These buckets have been given great thought in design and are constructed of the best materials to be obtained to withstand the strenuous service to which they are subjected.

Contractors throughout the length and breadth of the United States are using these buckets for all kinds of work, for excavating sand and gravel in sewer work, for excavating



OWEN BUCKETS HANDLING SAND AND GRAVEL FROM CAR TO BIN, EXCAVATING A TRENCH FOR PIPE AND DREDGING

bridge pier footings, building foundations, for work in stiff blue clay, stripping, excavating brick clay, rehandling purposes and handling gravel, sand and coal.

The success of the clam-shell bucket when rehandling material depends upon its ability to take big grabs and take them quickly in any one of the various materials which are handled with buckets to-day. This material runs from loose sand in stock piles to packed slag and crushed stone in cars. It is obvious that the bucket which gives the desired capacity in the latter will bury itself in the former. Therefore, a bucket with a quick and powerful digging action is desirable. The Owen bucket has a 7 to 1 closing power, adaptable to the hardest kind of service, which may be quickly changed by a slight adjustment in the reeving to a 5 to 1 closing power which is sufficient for all material-rehandling purposes. With this reeving, the length of the line reeved in the closing blocks is reduced considerably and the bucket opens and closes very rapidly.

In addition to being adjustable in closing power the Owen is adjustable in weight. This adjustability takes place on the main shaft. Thus by attaching jackets to the counterweight on the main shaft the digging power of the bucket is utilized, as every pound of weight placed at this point is used in the digging, and vice versa by detaching counterweight jackets, the weight is decreased and the crane or derrick is relieved of much unnecessary weight when handling certain kinds of material.

The conditions encountered when digging under water are very different from those met in other work, and because of this it is imperative that extreme care be exercised in selecting the proper bucket. It is absolutely impossible for the operator to "place" the bucket when dredging, as is usually practiced when operating in the open. Unless the bucket used for dredging has the essential qualities, a majority of the loads will be very small and the cost per cubic yard for the work will be far higher than justifiable.

The Owen bucket is claimed to be exceptionally adapted for dredging, owing to the greater part of its weight being located at the lowest part of its construction when open. This distribution of weight around the main shaft gives the bucket an extremely low center of gravity. Therefore, it will not tip over and its digging ability is not affected by the position in which it rests on the material. Users of these buckets for dredging purposes are reasonably certain they will get a grab of material every time the bucket goes after one. The shell of the Owen bucket is practically water-tight. This is due to heavy, rigid hinge connections, which, with the aid of two guides riveted on two of the side plates, keep the jaws in alignment with each other and thus prevent the loss of material while the bucket is in transit. It is also impossible for the closing or holding line cables to become entangled in or caught on any part of the construction of the bucket, regardless of the length of line paid out.

The output of the bucket can be greatly increased by bolting on extension plates when dredging materials in which the bucket fills to overflowing. These plates in addition to permitting a considerable increase per grab over the rated capacity of the bucket, also prevent the action of the water from washing the top off the load when hoisting, an important matter in this service.

ATTRACTIVE CONCRETE BRIDGE OF THE ARCH GIRDER TYPE LOCATED ON THE XENIA-WILMINGTON PIKE, CLINTON COUNTY, OHIO

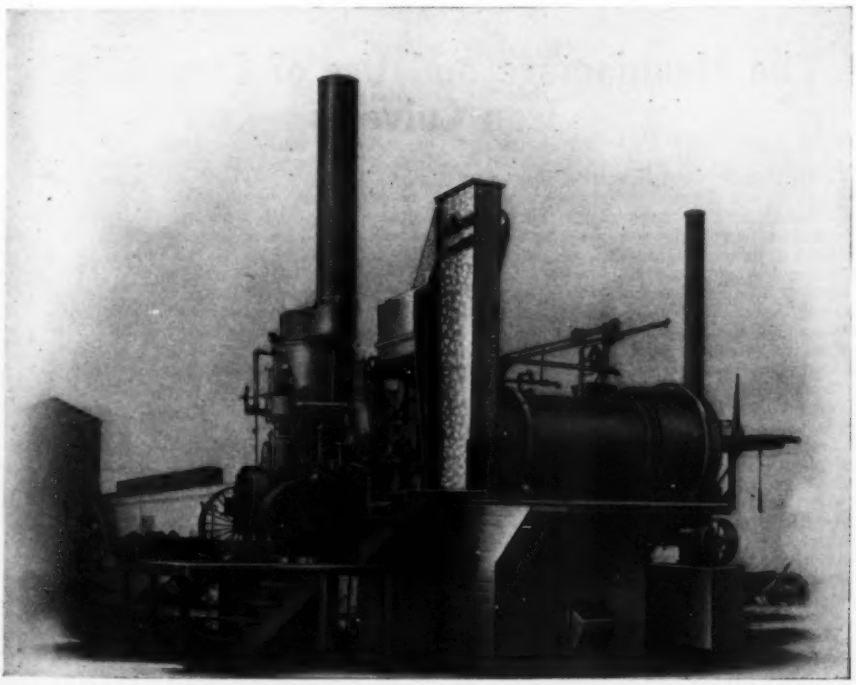
Built by Stout & Stout, of Stoutsville, Ohio. Cement from the Ironton, Ohio, plant of The Alpha Portland Cement Company

A Complete Portable Asphalt Plant

SOME manufacturers of portable asphalt plants aim to make a small edition of a large-size permanent proposition by paring and shaving down the size, weight and working capacity of the various units until they are small enough to mount on four wheels. The portable asphalt plant which is manufactured by Warren Brothers Company, Boston, Mass., does not come under this category, as it is a full-size plant of its type, being a radical departure from the old type of paving plants. Asphalt topping, asphalt binder, the so-called open mixture, and the Topeka specification mixture can be made with it with equal facility, and in shifting from one mix to the other no change whatever is necessary in the plant itself. In addition to its ability to properly make any kind of new wearing surface, it is also adapted to heating and reworking old sheet asphalt wearing surface for use in making repairs to existing pavements, and accomplishes this without injuring the asphaltic cement in the older pavement. Some of the plants of this type have been used continuously for a number of years on such work, making a considerable saving in the cost of the resultant mixture, since but little extra asphalt cement is required to rejuvenate the old pavement when properly heated.

The capacity of this plant naturally varies with the amount of moisture present in the mineral aggregate used and also with the skill of the operators and the general conditions under which the plant is operated. Under ordinary working conditions, however, the plant has a capacity of 100 to 150 square yards per hour of wearing surface, which will make 2 inches after compression, using sand containing 5 per cent moisture.

Many of these portable plants are being continually operated at an average daily output of 1,000 square yards and more of full thickness 2-inch wearing surface. The large capacity of this plant as compared to its size and first cost has materially reduced the demand for asphalt plants of the older types having a capacity up to 1,200 square yards per day. Some contractors or municipalities prefer to work two of these plants together rather than one of the old types of twice the capacity, so that when the large contract is finished they have two complete plants to take care of two other contracts in different cities or different jobs at the same time, with smaller outlay than if their



A WARREN BROTHERS PORTABLE ASPHALT PLANT MOUNTED HIGH TO PERMIT TRUCKS TO RECEIVE LOAD FROM MIXER BY GRAVITY

investment were in one plant which could only attend to one contract at a time.

The simplicity of construction and operation of this plant necessitates fewer expert attendants and naturally results in a larger saving on repair work or on intermittent new construction where it is not economical to organize the operating force to obtain the full capacity of the plant continuously. Because of this decrease in the fixed overhead expense, the cost of labor in running the plant is more nearly proportionate to the output than is possible with some other types of plants.

One of the reasons for the uniformity of the product of this plant is the large size of batch used. It usually consists of 3,000 pounds of mineral aggregate with the proper amount of asphaltic cement. The natural variation in the screen test of the mineral aggregate as it is taken from the storage piles is thus averaged up much better than when the batches are only one-fifth or one-sixth as large. Each batch as it is measured out is kept by itself until it is discharged as mixture into the wagon to be hauled to the street. At each stage in the operation of the plant and the passage of the different batches through, it is under the independent control of the operator.

When the plant is used in mixing asphalt topping, limestone dust is dumped into the receiving hopper of the elevator with the sand, and goes into the drier with the sand, where it becomes thoroughly mixed with the sand and heated at the same time, so that when the charge is dumped into the mixer the limestone dust is of the same temperature as the sand, insuring a much more uniform distribution of the asphalt cement through the mixture with less liability of the mixture's balling than if cold limestone dust is added in the mixer. The hot sand, being relieved of its duty of drying and warming up the limestone dust filler, does not have to be heated to as high an initial temperature as in the older method, and hence there is less danger of burning the asphalt cement when it is first added to the sand.

The plant is self-contained and is mounted on one truck, with the exception of the melting kettles, which are mounted independently. The weight of the plant proper, complete, is approximately 29,000 pounds, and each of the melting kettles weighs approximately 4,800 pounds additional. The small tools which go with the plant weigh a little over 1,000 pounds more, so that the total shipping weight of the plant with two 900-gallon portable melting kettles is about 39,500 pounds. The proportions of the plant are such that the whole outfit may be loaded on a 40-foot flat car or gondola car, taking the minimum freight rate on all railroads and permitting rapid shifting of location when necessary.

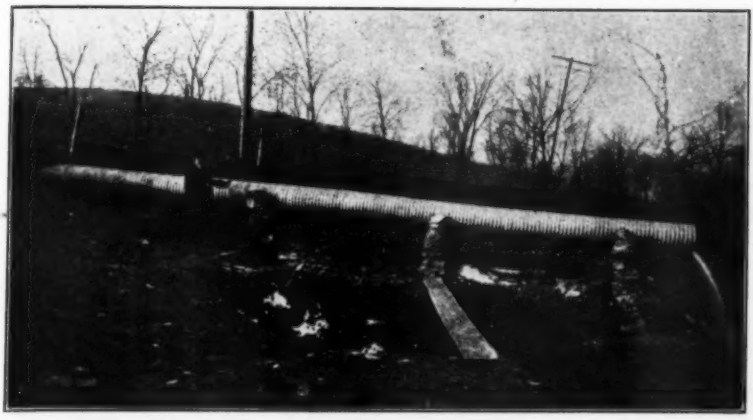
The Manufacture and Use of Corrugated Iron Culverts

THE factory of the Newport Culvert Company, 542 West Tenth Street, Newport, Ky., is one of the largest in the country devoted to the manufacture of corrugated, galvanized genuine open-hearth iron culvert pipe. The factory contains every known safety device, which is aimed not only to increase production, but to look after the welfare of the men. The factory is run on three 8-hour shifts, which insures continuous production for the entire 24 hours. Two large electric cranes in the buildings make it possible to load culvert pipe and the other products of the company night and day, rain or shine.

Newport corrugated culverts are made of open-hearth iron, which is 99.875 per cent pure iron copper alloy. Corrugations greatly increase the strength of the pipe over a plain cylinder of the same diameter. A typical analysis of metal cut from one of the culverts showed carbon .012, manganese .019, phosphorus .010, the low carbon and manganese indicating the material as typical of an iron manufactured in the open-hearth furnace.

These culverts are made in full-round and half-round types. The half-round type is an ideal shape for city and town use, for several reasons. Usually storm water runs lazily through a town drain pipe because there is not the fall that it is possible to get on a country road. Hence, the problem of keeping these drain pipes open is a big one. A 15-inch Newport culvert pipe is only about 8 inches high, but spreads out at the bottom to 15 inches. This allows the full capacity flow at the start and the smooth flat bottom made of heavy galvanized sheets does not retard the flow of water as other types of construction do. Furthermore, the bottom sections are made in 6-foot, 8-foot and 10-foot lengths. By using these separately or combining, it is possible to get the 6-foot length for drainage under sidewalks and any longer length desired in multiples of 2 feet. The top sections come in 2-foot lengths, which is not only a convenient size for handling, but simple to put in or take out whenever necessary. This type of culvert is shipped closely nested and takes up very little space in storage.

There are any number of instances of the value of a full-round type. A case illustrated herewith shows an 18-inch diameter Newport culvert pipe, 80 feet long, carrying water to waste 36 feet from the road-bed in Campbell County, Ky. It was found necessary to direct the flow of the water to a considerable distance away from the road. The short lengths of vitrified or terra cotta pipe which were formerly used here did not carry the water to a

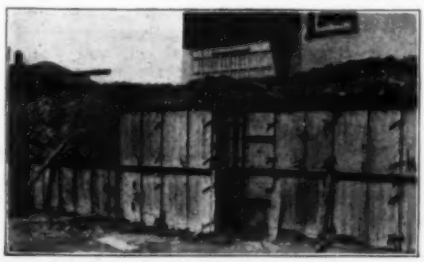


AN 18-INCH-DIAMETER NEWPORT CULVERT 80 FEET LONG CARRYING WATER TO WASTE 36 FEET FROM THE ROAD-BED, WATER-WORKS ROAD, CAMPBELL COUNTY, KENTUCKY

sufficient distance, so that it kept washing the dirt around the end of the pipe, until, section by section, it gave way, seriously endangering the road-bed. The installation of the corrugated pipe, while a trifle higher in first cost, has paid for itself in the protection it has afforded the road, to say nothing of the convenience and satisfaction of traffic.

Building Concrete Foundations with Standard Steel Forms

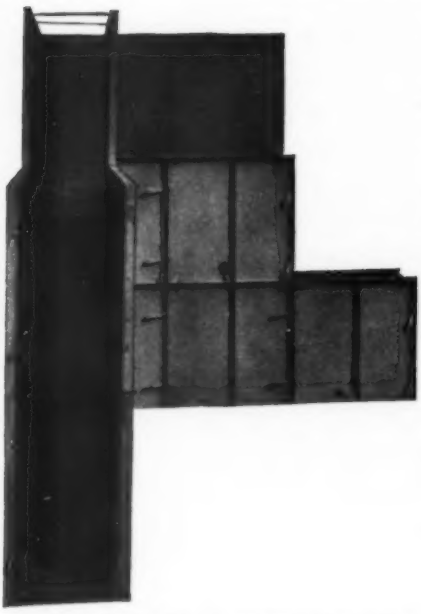
A SYSTEM of metal forms based on a standard plate unit 24 inches square and readily adaptable to every variance of dimensions in any type of modern concrete building construction, has been developed by the Reichert Metal Concrete Forms Company, 1188-1200 Weil Street, Milwaukee, Wis. Fractional sizes of this standard plate, graded down by 2-inch divisions to a 2-inch plate, permit the construction of walls of any length and pilasters of any dimensions, as well as columns and chimneys in residence construction. Rigid and hinged corner connections enable the building contractor to make angles of any degree.



MAKING A JOG IN THE WALL WITH REICHERT METAL FORMS

The casting face of the mold is made of non-corrosive, blue annealed, patent, leveled sheets of 16-gage metal, to which concrete does not readily adhere and which is easier to clean and makes a perfectly smooth wall. The angles which reinforce the plates are of mild steel 1¼ x 1¼ x ⅛ inches, riveted to the four sides of the sheet, and there is also a center angle which acts as a stiffener. In the angles on the top of the mold are holes through which spikes are placed, going through the holes in the spreaders, which give the desired thickness of the wall. Two, three or four courses of molds can be set up and poured at one time. If two or more courses are poured at one setting, the spacer is removed as soon as the concrete is poured, the wire, which also ties the molds, holding them in shape.

Each plate is further provided with three clamps made of soft steel and stamped to shape. These clamps are riveted securely to each unit, two on the side of the right upright angle, and one on the lower horizontal angle which is to lock the forms top to bottom. When not in use the locks hang downward out of the way and are in no danger of being broken off when the plate is thrown around and moved from one job to another. When the molds are



SPACING ARRANGEMENT OF THREE COURSES OF FORMS

locked together, the clamps pass through the slots in the angle of the next mold, locking them securely together and at the same time lining them up. Therefore, the plates cannot shear at the junction of two plates, because the clamps which hold them pass through the angles and prevent shearing and spreading. A firm water-tight joint is thus secured. No loose parts need be continually replaced in this system, nor does the form setter require any extra fittings, nothing but ¼-inch spikes to drop into the holes of the spacing irons which are furnished with the molds. The holes for the spacing irons are 2 inches from the edge of the angles on the top of the form. There are also ¼-inch holes in the vertical angles 4 inches from the top and bottom to wire the forms together similar to the wiring of wooden forms.

A 1¼ x 1¼ x ⅛-inch angle with two small hooks riveted to it supplies an outside corner connection by which walls can be rapidly angled. The inside corner connection is a 2-inch angle iron having two smaller angles riveted on the edge of each flange. This corner also has two hooks riveted to it to connect to the molds, and forms a perfect angle. A hinged corner, often used on iron rectangular buildings and on bay windows for residence work, is also provided, and with such an outfit of molds a contractor can erect a building of any size, height, shape or description.

The following comparison of costs using Reichert molds and wooden molds is of interest. A building 40 x 60 feet, 10 feet high and with 12-inch walls, giving 2,000 square feet of wall in wooden forms, would require 8,000 feet of 2-inch plank and 1,000 feet of bracing; 9,000 feet at $50 per thousand gives $450 or 22½ cents per square foot. Assuming that the lumber can be used 6 times, this makes a cost of 3¾ cents per square foot.

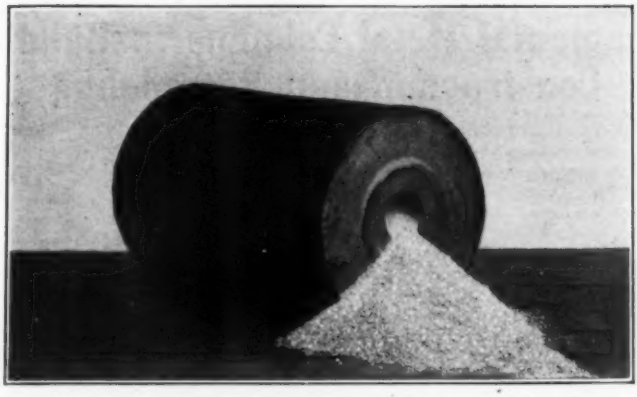
With Reichert metal forms the cost for two courses or 400 side plates is $1,300. When the forms are used 25 times, the cost is 2 3/5 cents per square foot; when used 50 times, 1 3/5 cents per square foot; and when used 100 times, 3/5-cent per square foot. It is claimed that one set of Reichert forms are good for 500 buildings, and with good care and slight repair for 1,000 buildings.

The Use of Calcium Chloride on Roads

MANY highway superintendents do not realize the value of calcium chloride in road work. Calcium chloride is a clean, white chemical salt with the peculiar property of attracting moisture to itself. It quickly dissolves when exposed to the air and readily combines with the surface to which it is applied. It is odorless and harmless, does not track or stain, and is without effect on rubber, horse-hoofs, or clothing. Because of its property of absorbing moisture from the atmosphere, it is a natural dust-layer. It is a good surface road-binder, and when applied it soon becomes incorporated with the top course and retains sufficient moisture to lay the dust and keep the surface in a smooth, slightly damp, compact condition. In practice, calcium chloride absorbs the moisture during the night and will dry out somewhat during the day, but as it renews its moisture content each night, the process is continuous, thereby maintaining a dustless, smooth-surfaced road at all times. It also acts as a weed deterrent.

The Semet-Solvay Company, Syracuse, N. Y., manufactures calcium chloride in four forms—liquid, solid, granulated, and flakes. For road work, particularly, the granulated or flaked form is employed. It is shipped in air-tight sealed drums, containing 350 pounds net. The material is ready to apply upon opening the drum.

One of the advantages of flaked or granulated calcium chloride is that it may be applied by unskilled labor. It may be spread quickly and easily with ordinary shovels to cover small surfaces, and by horse-drawn or motor-drawn spreaders when the surface to be covered is large in extent. To obtain the best results,



TYPE OF SEALED DRUMS IN WHICH FLAKED AND GRANULATED CALCIUM CHLORIDE IS SHIPPED

it is essential that there be an even distribution of material. The surface of the road to be treated should, if necessary, be put in shape previous to the application of the calcium chloride. Under ordinary conditions about 1½ to 2¼ pounds of material per square yard are necessary for the first application, which should be followed by a second treatment later in the season. The interval between applications depends upon the quality and condition of the surface of the road and the character and volume of traffic.

Under modern traffic a good surface should not require more than two applications per year, while under heavy traffic three may be necessary.

Labor Unions Would Eliminate the Contractor

General Contractors Called Parasites and Their Extermination Urged

IN the heat of the discussion preliminary to the arbitration proceedings recently conducted by Judge Landis, several of the trade union leaders publicly urged that the general contractor be eliminated from the industry and the public deal direct with sub-contractors and reliable architects, thus saving the middleman's profit of 12 per cent. The idea is not a new one. Everybody but the original producer and the ultimate consumer is a middleman of one variety or another, including the union leaders, the architects, the sub-contractor, as well as the general contractor, and should be eliminated whenever possible. The main question is rather, "When is it possible to eliminate the middleman and which middleman shall it be?"

Houses, of course, can be built by carpenters without the help of the general contractor, sub-contractors, architects, or any other assistance than a gang of laborers. Skyscrapers require different treatment. Buildings may be erected by sub-contractors dealing direct with the architect without the general contractor, but the work the general contractor does in managing, coördinating, directing, supervising and financing must be done by someone and paid for ultimately by the owner. The economies of the situation are that whatever job is big enough to warrant the attention of a general contractor, the cost will be less by engaging him as manager, or he would never have become a leading element in the system. Where jobs are such that they do not need an executive manager, the general contractor is perfectly willing to let anybody who wishes tackle them. It has never proved economical, however, to combine the functions of the architect and the general contractor on jobs of any importance, for the result is bound to be a poor architect or a worse manager.

No one is really much alarmed at the attempt of some people arbitrarily to determine the economy of industry. In a free system, they take care of themselves.

Ornamental Metal Columns in Building Construction and Remodeling

IN modern building construction, and very frequently in remodeling older structures, architects and building contractors make use of metal columns, because they present a more permanent unit than the older type of wooden columns. The Union Metal Manufacturing Company, Canton, Ohio, furnishes metal columns which are architecturally correct. They have entasis and stopped flutes and other characteristics which mark the columns of the ancient classical orders. They are so constructed that they do not split, check, rot, warp or open at the joints, and cost but little more than wooden columns; consequently, they are used on a great deal of work for which wooden columns were formerly used.

THE RESIDENCE OF JUDGE J. C. EGGLESTON, FRANKLIN, TENN., BEFORE REMODELING

The shafts of the columns are made from 22-gage open hearth galvanized steel. It is tight-coated with spelter which adheres perfectly to the metal under all conditions and protects it from the weather. Shafts up to and including a base diameter of 14 inches are made of 1-ply, No. 22-gage galvanized steel. All shafts over 14-inch base diameters are made of 2-ply No. 22-gage pressed and fluted together. The seams of the columns are securely locked and always turned on the inside of the shaft. All columns are designed so that the weight does not fall upon any of the composition capitals, but is impressed through a cylindrical steel core pin directly upon the steel shaft itself. Before leaving the factory, the steel shafts are painted with a coat of galvanized iron primer. The cast iron parts are coated with a high-grade metalastic paint. This completes the protection against the elements and furnishes a surface on which the finishing coats of paint can be applied with assurance that they will not crack or peel.

The principle of the construction of these columns—the fluted steel cylinder—is in accordance with the best practice. It insures maximum compression strength and makes them several times stronger than wooden columns. They are furnished to withstand all normal weight without reinforcement. However, where an abnormally heavy pediment or weight is to be supported, they may be reinforced by a steel I-beam or by tubular steel poles which pass up through them, or they may be economically filled with concrete. This practice is usually resorted to in interior work, such as stores, colonnades, hotel lobbies, etc., where the columns are called upon to support the building and at the same time perform the function of architectural beauty.

Remodeling with Metal Columns

Metal columns can be used to great advantage in the remodeling of old-time buildings into attractive modern structures. The plain, unattractive square lines of the early architecture need the relief and contrast afforded by the classical column. The addition of porches and balconies also serves the same purpose.

There is a wide field here for the building contractor to develop. There are many people who would much prefer, because of associations or sentiment, to remodel some old-time homestead, school or church than to build a new one. The illustrations herewith show the effects that were obtained in Franklin, Tenn., in one case where Union metal columns were used.

THE TRANSFORMATION OF JUDGE EGGLESTON'S HOME

Shirley Joins A. A. A.

Henry G. Shirley, until recently Secretary of the Federal Highway Council, Washington, D. C., has been appointed chairman of the Good Roads Board of the American Automobile Association, succeeding George C. Diehl, who recently became President of that organization.

Stucco in Building Construction

STUCCO may be applied to bricks, stone, hollow tile, concrete block and monolithic concrete walls and may also be applied to frame structures on metal lath or stucco board. The average cost of stucco above the usual wood type of construction is 3 per cent. Conditions must determine whether one-, two- or three-coat work is necessary. If the wall is rough and uneven, three coats should be used. To obtain a uniform color, three coats are necessary for a slap-dash finish; for the second and third coats, if specially attractive work is desired, Medusa White Portland cement, made by the Sandusky Cement Company, Cleveland, Ohio, may be used. For stipple finish, three coats are also recommended, using Medusa White Portland cement in the second and finish coats.

Plasterers' hair may be used in the first coat for stucco work, in the proportion of one pound to one sack of cement. The use of hydrated lime is recommended to the extent of from 10 per cent to 15 per cent of the weight of cement, as it makes the mortar more plastic and adhesive. It works easier under the trowel and assists to a great extent in preventing hair-cracks. The cement and hydrated lime should first be thoroughly mixed in dry form; then the aggregate should be added and mixed, before the addition of water.

The lath or surface to which the stucco is being applied must be thoroughly wetted (with clean water) to prevent absorption of water from the fresh mortar, and still be moist before the application of each coat to insure a perfect bond. The finish coat of stucco should be kept moist by spraying with water for at least a week, and protected from the direct rays of the sun or warm winds by means of a damp canvas or burlap, frequently sprinkled. This will prevent hair-cracks and checking. Excessive troweling should also be avoided, as this is often the cause of hair-cracks on flat or smooth surfaces.

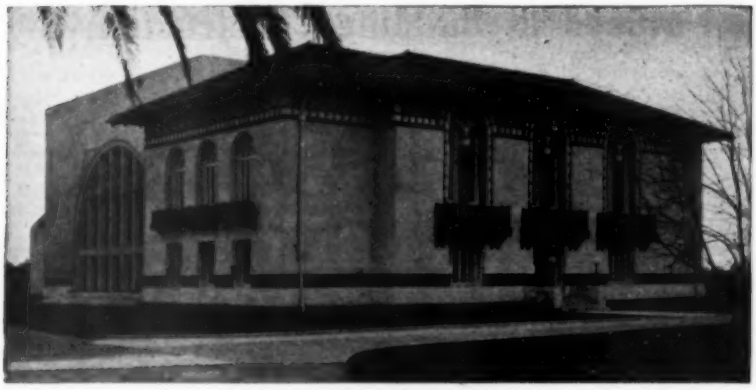
The plastering should be started at the top of the wall and carried downward. Care should be taken to make the stucco work continuous; that is, one batch of plaster must not be allowed to dry before the adjoining space is covered. If it is impossible to work the full width of the wall at one time, the joint should be at some natural division of the surface, such as a window or a door. If this precaution is not observed, cracks and differences of color are likely to occur in the finished surface. Stucco should never be applied when the temperature is below freezing. Only a small quantity of plaster should be mixed at one time—not more than will be used within one hour, so that the cement will not have an opportunity to set before being used.

AN ATTRACTIVE PIECE OF STUCCO WORK IN CALIFORNIA
The residence of U. S. Senator James E. Phelan, near Los Gatos, Calif.

One barrel of Medusa White Portland cement, equalling 4 sacks of 94 pounds net each, and two parts of aggregate will cover 480 square feet to a depth of ¼-inch, 240 square feet to a depth of ½-inch, and 160 square feet to a depth of ¾-inch.

Colored Concrete

Any desired color can be produced in the stucco by the use of dry color materials with Medusa White Portland cement, making possible permanently artistic and brilliant effects not obtainable through the usual grades of



Courtesy the Sandusky Cement Company, Cleveland, Ohio.

AGNEW'S STATE INSANE HOSPITAL, AGNEW, CALIF.

This building is one of the many in this institution covering 331 acres, and houses the Assembly Hall and Club-Rooms

Portland cement. The coloring matter should be mixed thoroughly with the sand until a uniform color results, and should then be mixed with the cement. The Portland Cement Association in its "Cement Stucco" bulletin discusses this subject as follows:

"One of the most important questions, and one that is bound to arise whenever the use of coloring-matter in cement is contemplated, is that of permanency. Blacks are safe colors, as a rule, although it is better to avoid experiments with cheap blacks. The carbon blacks are preferable to lampblacks, because they do not have the same tendency to float to the top during mixing. There are fewer grades of carbon blacks, and there is therefore less likelihood of getting a worthless color. Ultramarine blue, if of good quality, will hold its color for a number of years, and generally possesses the virtue of fading out evenly when it does finally lose its color. It cannot be classed as a permanent color, as is black, brown or ochre.

"Green is an unsatisfactory color to experiment with. Commercially, there is no green cement color on the market that will not fade when mixed with cement and exposed to light and weather.

"Reds and browns need little comment in addition to the explanation given in the Table of Colors. Yellow ochres offer a wide variety of shade and quality. French ochre, if genuine, is safe to use, and with it most attractive colonial yellow and buff tones can be secured. There are a number of good yellow ochres manufactured in this country, but naturally they are not of the cheapest variety. It is always safe to know the name of the manufacturer and also whether or not the color was specially designed for coloring cement."

Finish

Smooth finish.—A smooth finish can be secured by bringing the final coat to an even surface with a steel trowel, with as little rubbing as possible.

Stippled.—After a smooth finish is secured, pat lightly with a whiskbroom when sufficiently set to obtain a uniform surface.

Sparkling finish.—Make a 10 per cent solution of muriatic acid in water and scrub with stiff brush after final setting. Thoroughly rinse with clean water.

Slap-dash or rough cast.—After the second coat has been brought to a smooth, even surface and before attaining final set, dash on the third coat evenly with a wooden paddle, to produce a rough surface of uniform texture when viewed from a distance of 20 feet.

Pebble-dash.—A pebble-dash surface can be secured by applying the final coat fairly wet and then throwing clean pebbles into the fresh plaster. The pebbles should be about ½-inch in diameter and should run uniformly. Be-

TABLE OF COLORS

Color Desired	Commercial Names of Colors for Use in Cement	Pounds of Color Required for Each Bag of Cement to Secure: Light Shade	Medium Shade
Grays, blue-black and black	Germantown lampblack	½	1
	Carbon black	½	1
	Black oxide of manganese	1	2
Blue shade	Ultramarine blue	5	10
Brownish-red to dull brick red	Red oxide of iron	5	10
Bright red to vermilion	Mineral turkey red	5	10
Red sandstone to purplish red	Indian red	5	10
Brown to reddish brown	Metallic brown oxide	5	10
Buff, colonial tint and yellow	Yellow ochre	5	10

fore throwing them on the fresh plaster the pebbles should be wet. The work should be started at the top and the pebbles thrown with a sweeping motion such as is used in sowing grain. The pebbles must, of course, be distributed evenly over the surface and must be thrown against the fresh, soft plaster with sufficient force to embed them securely.

Care must be taken not to disturb the cement after it has started to set, and in order to avoid this the surface must be covered with the pebbles immediately after the fresh plaster is applied. A plasterer by ordinarily quick work can cover a surface 6 feet square with plaster and then apply the pebbles, giving a very satisfactory job.

A Concrete Column Form Clamp

A Handy Device for Building Contractors

THE need of a quickly adjustable metal clamp for concrete column forms to replace the cumbersome time-consuming wooden clamp led to the development of the Sterling Column Clamp by the Sterling Wheelbarrow Company, Milwaukee, Wis. The clamp consists of four principal parts: a strong, malleable iron handle with heavy ribbed shoulder; a malleable iron ratchet clamping head which is riveted to and pivots upon the hand lever; a 14-foot length of 16-gage band steel, 1⅛ inches wide, firmly hinge-riveted to a steel locking lever; and a locking device with four openings attached to the steel band about 16 inches from the clamping head.

In using the clamp around a circular, square, rectangular or hexagonal column, the steel band is first passed around the column and then threaded through the clamping head and drawn tight. The band is grasped with one hand and the lever ratcheted several times until it resists further tension. Then the lever is pressed down close to the column, putting a permanent crimp into the band to prevent it from slipping. The lock clamp is then put into position by inserting the lock lever into the tightest opening of the locking device. When it is desired to knock down the form, it is only necessary to release the buckle.

Among the advantages of this type of locking device is that it costs considerably less than other somewhat similar devices on the market, it can be used over and over practically indefinitely, and even when a band does break after years of service it can be replaced for about 25 cents. It takes only from ½ to 1½ minutes to put the clamp around a column, and any common laborer can do it. It permits the pouring of a whole column at once or makes it possible to build the form on the ground and then erect it as a single unit.

Because of the small size of the bands, it is possible to apply this clamp to forms which are almost tight against an adjoining wall or other obstruction, and also permits the use of lighter lumber for the forms, thus saving considerable money on this item.

The illustration on this page shows col-

WOODEN COLUMN FORMS WITH STERLING CLAMPS ON THE RICE SQUARE SCHOOL BUILDING, WORCESTER, MASS.

umns erected for the Rice Square School Building, Worcester, Mass., which was built by the Central Building Company, general contractors, Worcester, Mass. In commenting upon these clamps, William Shumway, Vice-President of the Central Building Company, stated: "They are easy to place, holding the columns square and in place until the concrete is filled in. They are easily removed from the columns after the concrete is in place."

Spotting Building Material Deliveries

Short Wheel Base Motor Truck Shows Its Value

PRACTICALLY every building contractor has experienced difficulty in landing lumber, cement, brick, and other building materials at the best place on the job. In order to do this, many times it necessitates double handling, thus running up labor costs. The Gunn-Van Dale Company, building contractors, Newark, N. J., make use of a short-wheel-base Autocar truck in speeding up the progress of new building construction and in general contracting work. Because of the ability of this truck to get into cramped places and to deliver the load at exactly the right spot, it has materially expedited the work. The accompanying illustration shows the company's Autocar delivering lumber in a tight place for the new building of James A. Coe & Company, Newark, N. J.

GETTING INTO A CLOSE PLACE TO DELIVER THE GOODS

Open-Shop Arguments

What Is Sauce for the Goose Should Be Sauce for the Gander

WHEN we sift down the argumentative claims and counter claims in the open-shop arguments as between employers and employes it resolves itself into this: The union leaders object to the open shop mainly because it makes more difficult the securing of the full membership in their unions. The closed shop makes union membership compulsory, while the open shop would leave it purely voluntary and more likely result in a dwindling membership. That apparently is why the union leaders maintain that the open shop policy is intended to break up the unions.

The employers, on the other hand, claim that the closed shop would prevent them from employing non-union men and would hamper their freedom in choice and movement, and in this they are undoubtedly right. The union leaders really have a poor line of argument here because unless they can maintain their membership on a voluntary basis without a closed shop then they do not deserve to maintain it. No association of business men would be permitted to use the closed-shop principle in its work and discriminate in any manner against non-members. This is both law and logic and it should be applicable to labor unions as well as business associations.—*The Clay Worker.*

Concrete Highway Bridge and Culvert Standards—Part I

State Culvert and Highway Standards Tabulated and Discussed

By A. C. Irwin

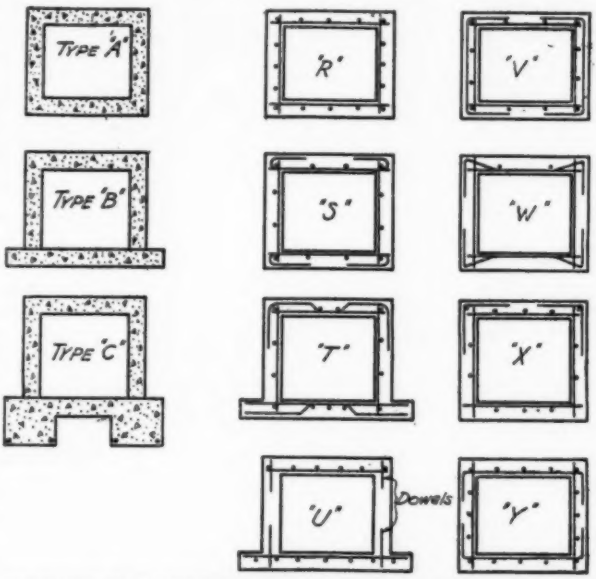
CONCRETE is now serving as the material of which many highway bridges are constructed for all sorts of openings, ranging from a small-diameter single concrete pipe culvert to the enormous arch span of 400 feet now under construction over the Mississippi River at Minneapolis, Minn. The types of concrete bridge structures now in use are almost as numerous as those developed for steel construction. The spans for which these various types are suitable overlap each other so that a well-recognized type is available for any span, from the shortest to the longest.

Many of the types developed follow rather closely the form of accepted designs for steel structures, and, as with them, the length of span at which absolute economy would dictate that one type give place to another is not clearly defined. Thus, before the maximum diameter of concrete culvert pipe is reached, the box culvert, either single or multiple, is used. The reinforced-concrete slab and the plain concrete arch culvert come next in the increasing scale of spans, followed by the girder type, which has been used for spans of over 140 feet. The ordinary spans for which girders are used are as great as the spans of thousands of reinforced-concrete arches, but the arch type is the present accepted one for long spans.

The rainbow arch and the concrete truss have also received considerable attention in the last few years and give promise of extending the economical length of span beyond that already obtained by the strictly concrete girder type.

Concrete Pipe Culverts

Concrete culverts may be divided into two classes, depending upon the method of construction, namely, cast in place culverts, and precast pipe culverts. The states of Delaware, Oklahoma and Missouri have standards and specifications for precast culvert pipe, and standard designs were received for pipe culverts from Delaware, Illinois, Oklahoma and Missouri. Diameters of pipe culverts range from 12 to 36 inches in these standard designs, and the thickness of the shell from 3 to 11 inches for those cast in place and from 2 to 4 inches for precast pipes. Illinois uses concrete pipe culverts in which a light pipe is used for an inside form and is encased in 4 inches of concrete.



COMPARISON OF ARRANGEMENTS OF REINFORCEMENT FOR CONCRETE BOX CULVERTS

At left—Three standard box culvert sections

DATA ON BOX CULVERTS

State	Size of Opening		Length	Head-wall Type	Reinforcing Scheme	Footing Plan
	Min.	Max.				
Alabama	3′ x 2′	....	Variable	45°	R	A
California	3′ x 2′	8′ x 8′	Variable	30° & St.	U	B
Colorado	1′ 3″ x 10″	10′ x 10′	Variable	45°	W	A
Connecticut	2′ x 3′	5′ x 3′	28′	St.	S	A
Georgia	2′ x 2′	8′ x 8′	Variable	45°	R	A
Idaho	3′ x 3′	5′ x 5′	Variable	30° & 45°	W	A & C
Illinois	....	....	.....	St. & U.	V	A
Indiana	2′ x 2,	5′ x 5′	Variable	St., U. & 45°	V	A
Maryland	1′ 6″ x 1′ 6″	5′ x 5′	Variable	St.	R	A
Mississippi	4′ x 4′	10′ x 6′	Variable	45°	R	A
Nevada	2′ x 2′	10′ x 10′	Variable	30° & St.	R	A
New Hampshire	2′ x 2′	5′ x 5′	21′ to 39′ 6″	St.	R	A
Missouri	2′ x 1′ 6″	12′ x 6′	24′	St. & 45°	S	A
New Mexico	4′ x 4′	....	Variable	St.	Mod. R	A
North Carolina	6′ x 4′	....	Variable	30°	R	A
Oklahoma	2′ x 2′	8′ x 8′	24′ to 40′	St., 45°, U.	U & V	B & A
Oregon	2′ x 2′	8′ x 8′	24′	45°	T	C
South Carolina	....	8′ x 9′	28′	45°	R	B
Tennessee	2′ x 1′ 6″	10′ x 8′	....	45°	R	B
Texas	2′ x 2′	10′ x 5′	24′ to 30′	30°	R	A
Virginia	3′ x 3′	6′ x 6′	Variable	45°	X	B
West Virginia	....	....	Variable	30°, St., 45°	....	A
Wyoming	3′ x 3′	6′ x 6′	24′-48′	45°	X	B

Delaware uses the wing type of head-wall with footings, as distinguished from the straight type used by the Illinois Highway Commission. Standard practice is to lay the culvert with a slope equal to that of the stream flow, and apparently there is nothing to be gained by increasing this.

The plans received for concrete pipe culverts are not sufficient in number to arrive at any conclusion about standard practice in the use of extension or cut-off walls at the up- or down-stream ends of the culvert, or in regard to the use of aprons at the down-stream end. However, standard plans for concrete box culverts indicate that a vast majority of state engineers consider cut-off walls necessary, at least on the up-stream side of the culvert.

Box Culverts

The table above gives some of the points of difference exhibited by the standard designs for box culverts of various state highway commissions. It will be noted that concrete box culverts of the minimum size of 2 by 2 feet are standard for seven states of those reporting, and that 12 feet is the maximum span. The illustration gives a comparison of types of sections and arrangements and location of reinforcing and construction joints.

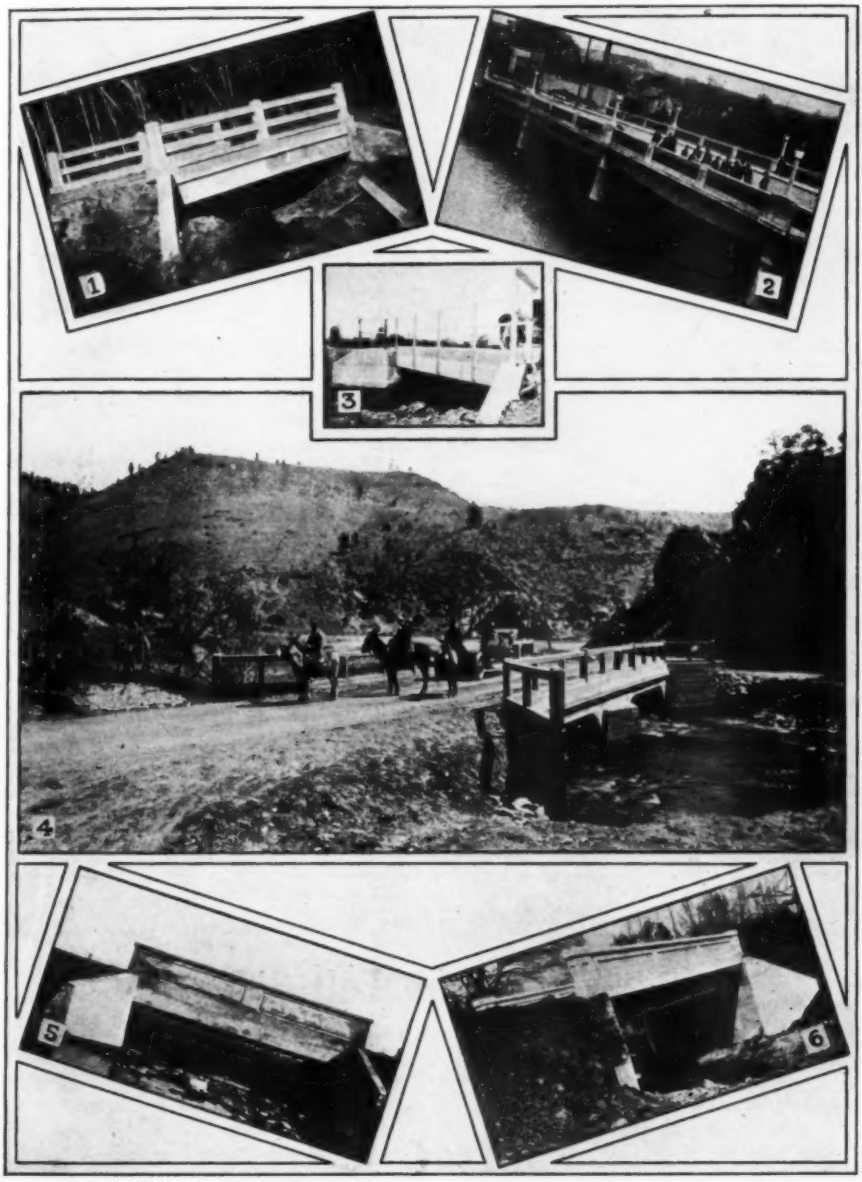
The common practice is to set a minimum depth for cut-off walls which can be increased at the discretion of the highway engineer. This minimum depth seems to be about 2 feet. These walls prevent scour at the down-stream end of the culvert barrel, assist in anchoring the culvert in place and also in reaching firmer foundations at points where the upper layers of earth are soft and non-resistive.

Separate foundation footings are seldom shown, the floor of the barrel being depended on to spread the load to the soil. Construction joints are not generally shown in concrete box culverts. Where such joints are shown, they usually occur at the point of junction of the side walls with the floor of the culvert and are made with a groove in the slab in order to anchor the side walls against the thrust of the filling material.

It does not appear that the local conditions under which box culverts will be used are sufficiently different to call for any great difference in the thickness and reinforcing of the top and side walls.

Expansion joints are usually ignored, regardless of the length of the culvert, the designer apparently assuming that the difference in temperatures occurring under a fill will not produce sufficient expansion or contraction to cause serious damage to the culvert.

Undoubtedly, the depth of fill, both minimum and maximum, was given consideration by the designers when fixing the thickness of concrete and in specifying the amount of reinforcing to be used. None of the spans examined, however, show either a minimum covering for concrete box culverts, or the live load which the culverts were designed to carry. This applies also to the pipe culverts.



TYPICAL CONCRETE GIRDER AND FLAT SLAB CULVERTS ON AMERICAN HIGHWAYS

1. Girder type culvert with concrete rails, Thomas County, Georgia. 2. Reinforced concrete deck girder bridge over Fox River, Dundee, Ill., built in 1917, with four 55-foot 8-inch spans, a 42-foot roadway and two 8-foot walks. 3. Typical culvert in Wyoming. 4. Bridge over Bear Creek near Morrison, Colo. 5. A standard culvert at Bear Branch, Md. 6. A 35-foot deck bridge in North Carolina

DATA ON SLAB SPANS

State	Span Length Min.	Span Length Max.	Loading	Roadway	Head-wall
Alabama	6′	20′	15-ton truck and 30% impact	16′ to 20′	....
Arkansas	3′	20′	15-ton truck and 30% impact	22′	30°
Colorado	8′	20′	20-ton roller or 100 lbs. per sq ft.	20′	45°
Connecticut	6′	20′	.....	23′	30°
Delaware	6′	18′	20-ton truck or 200 lbs. per sq. ft.	32′	45°
Florida	8′	12′	15-ton truck with 30% impact, or 150 lbs. per sq. ft.	18′	45°
Georgia	6′	20′	15-ton truck with 30% impact, or 120 lbs. per sq. ft.	18′ or 20′	40°
Idaho	21′6″	21′6′	20-ton engine, 25% impact	18′	45°
Illinois	10′	20′	.....	16′ to 30′	....
Indiana	8′	20′	20-ton engine	28′	U and 45°
Maryland	6′	16′	.....	....	U and 45°
Mississippi	6′	20′	15-ton truck and 30% impact	16′	45°
New Mexico	12′	12′	.....	16′	45°
North Carolina	14′	14′	15-.on truck and 30% impact	18′	45°
Ohio	9′	20′	.....	20′ to 24′	45° and St
Oklahoma	2′	20′	15-ton truck with 30% impact, 120 lbs. per sq. ft.	20′	U-St-45°
Pennsylvania	2′	20′	.....	23′	30°
South Carolina	....	....	15-ton truck and 25% impact	....	30°
Tennessee	4′	24′	15-ton truck and 30% impact	16′	45°
Texas	8′	20′	.....	16′ to 24′	....
Vermont	5′	20′	.....	....	....
Virginia	8′	20′	.....	20′	45°
West Virginia	10′	30	.....	16′ to 20′	45°
Wyoming	7′	15′	.....	....	45°

Slab Bridges

It will be noted in the table "Data on Slab Spans" that the shortest span for which we find standard plans for slab bridges is 2 feet, and that the greatest span is 30 feet. Some highway engineers consider that spans over 20 feet should have plans prepared especially for them.

Difference in practice is shown in the matter of sliding joints for slab bridges. By far the greater number do not provide such joints for spans up to 20 feet. While it does not seem worth while to go to any considerable extra expense to provide sliding joints for ordinary slab spans, a computation of the unit stresses likely to occur under great ranges of temperature indicates that a construction joint at the seating of the slab on the pier or abutment should be made.

In Wisconsin State Highway Commission standard designs the railing is cast monolithic with the slab and is given a simple paneling. The abutments are of the reinforced concrete type. This is the prevalent type of abutment for slab bridges.

ACKNOWLEDGMENT.—Printed by permission from the forthcoming copyrighted proceedings of the American Concrete Institute, Vol. 17.

(To be concluded in the November issue)

Walk on the Left Side

An Important Principle in Reducing Street Accidents to Pedestrians

Pedestrians who use the state highways in rural sections are urged to walk on the left side of the highway.

By walking on the left side, the pedestrian will always see approaching cars, for he will be facing them. When walking on the right side he must trust the sight and skill of the drivers of cars and other vehicles.

One of the most important reasons for such a movement is the safety of night travelers. A man on foot can see an approaching car long before it reaches him because of the lights, but the driver of a motor vehicle cannot see a pedestrian at night until he is almost upon him.

This idea has been tried out in various ways, and it is a big improvement over the present practice of walking on either side of the highway.

LITERATURE WORTH LOOKING OVER...

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

MACHINERY FOR RESURFACING ASPHALT STREETS
The Lutz surface heater for softening asphalt and other bituminous pavements and vulcanizing new material to the old is described in detail in the literature of the Equitable Asphalt Maintenance Co., 1901 Campbell St., Kansas City, Mo.

AUTOMATIC LOADING MACHINERY
Contractors interested in efficient loading, unloading and conveying machinery for gravel, sand and cement on road and building jobs should get details regarding this type of machinery from the Fairfield Engineering Co., Lancaster, Ohio.

TRUCKS FOR CONTRACTORS
The General Motors Truck Co., Pontiac, Mich., has published an interesting, well-illustrated, 8-page booklet, particularly aimed to show the value of motor trucks in contracting and road building and to feature the methods by which motor trucks have revolutionized heavy hauling.

EXPANSION JOINTS FOR PAVEMENTS
Contractors interested in laying good concrete, brick, stone or other block pavements and protecting them against undue expansion, should write to the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio, and ask for a sample of Carey Elastite expansion joint and literature describing its advantages.

ELECTRIC MOTORS FOR VARIED SERVICE
If you want information regarding a motor for some particular service, write to the General Electric Company, Schenectady, N. Y., for full information.

CAST IRON WATER PIPE
Sizes and prices of Lynchburg pipe, together with data on the advantages and service of the Lynchburg Foundry Co., Lynchburg, Va., may be secured by writing to the above company.

SERVICE IN TANDEM MOTOR ROAD ROLLERS
Catalog FF issued by the Austin-Western Road Machinery Co., Chicago, Ill., tells you the reason why the Austin motor road roller is a saving proposition for road work.

GRADERS FOR ROAD WORK
J. D. Adams & Company, Indianapolis, Ind., has just published a new folder describing its complete line of graders for road work, and also introducing its new back sloper attachment and a new scarifier grader.

SPECIFICATIONS FOR CONCRETE ROADS
Contractors interested in securing the best specifications for concrete highway construction adaptable to various soil conditions should write to the Portland Cement Association, 111 West Washington St., Chicago, Ill., and ask for its booklets of specifications.

CEMENT SIDEWALK AND FLOOR TOOLS
Bulletin No. 34, issued by the Abram Cement Tool Company, 616 Marquette Building, Detroit, Mich., contains illustrated details and costs of the complete line of Abram finishing trowels, jointers, edgers, rollers, tampers and grout cutters.

COST OF REINFORCING CONCRETE ROADS
The National Steel Fabric Company, 909 First National Bank Building, Pittsburgh, Pa., has available for free distribution pamphlets containing two interesting articles as follows: "Steel Fabric in Concrete Road Costs One Cent to Place" and "Reinforced Versus Plain Concrete Highways," by H. Eltinge Breed, Consulting Engineer.

EXCAVATOR CRANES FOR ROAD WORK
Bulletin TX, published by the Excavating Machinery Div., Pawling & Harnischfeger Co., Milwaukee, Wis., contains interesting and valuable information regarding P & H 205 or 206 excavator cranes in road work.

HIGH-GRADE ROAD MACHINERY
The complete catalog of the Good Roads Machinery Co., Inc., Kennett Square, Pa., describes in detail its full line of high-grade road-building machinery, including Monarch four-wheel heating kettles, oiling machines, portable crushers, elevators, screens and stone bins, as well as steam rollers, graders, etc.

A POWER LOADING CONCRETE MIXER
The power loader folder C-E, published by the Gray Iron Foundry Co., Reading, Pa., contains interesting details regarding the Keystone power loading mixer, including a description of its measuring tank, which automatically and without fail supplies the proper amount of water for each mix.

AN ECONOMICAL CLAM-SHELL
Complete data regarding clam-shell buckets which are lubricated and have grit-proof main bearings may be secured by writing to the Owen Bucket Co., 418 Kirby Bldg., Cleveland, Ohio.

EXPANSION JOINT COMPOUND
Full information regarding an expansion joint compound produced from the highest quality of asphalt, which gives maximum efficiency and which has met the approval of exacting engineers and contractors, may be secured from the Pioneer Asphalt Co., Lawrenceville, Ill.

STRUCTURAL STEEL WORK
The Pittsburgh-Des Moines Steel Co., 836 Curry Bldg., Pittsburgh, Pa., will be glad to send literature to contractors needing any type of plate work or structural steel work.

INDUSTRIAL LOCOMOTIVES
Industrial steam locomotives which have met the test of service for many years are described in detail in the literature of the H. K. Porter Co., Pittsburgh, Pa.

CONCRETE-PRODUCING MACHINERY
The types of concrete mixers made by the Ransome Concrete Machinery Co., 1772 Second St., Dunellen, N. J., which have a reputation for cutting mixing costs, are described in detail in literature which may be secured from this company.

COST OF CAST IRON PIPE
Price lists and literature covering the uses of cast iron pipe may be secured by writing to the U. S. Cast Iron Pipe and Foundry Co., Burlington, N. J.

A COMPLETE ASPHALT MIXING PLANT
Bulletin No. 2-B, which may be secured from the Iroquois Sales Dept., Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa., describes in detail Iroquois portable asphalt mixing plants, which are the product of 40 years' experience in asphalt street and road building.

ONE-MAN EXCAVATORS
The Bay City Dredge Works, 2622 Center Ave., Bay City, Mich., will be glad to send literature describing its ⅜-yard capacity one-man excavator for clay, sand or gravel pits or road contractors.

TRACTORS FOR ROAD GRADING
The booklet "The Nation's Road Maker," issued by the Holt Manufacturing Co., Inc., Peoria, Ill., describes in detail completely motorized caterpillar outfits for grading and maintaining roads faster and cheaper than by other methods.

SURFACING BITUMINOUS ROADS
The Kinney Manufacturing Co., 3529 Washington St., Boston, Mass., will be glad to send its literature describing the advantages of the Kinney patent combination asphalt heater and distributor for applying hot or cold bituminous materials to road surfaces for construction, maintenance or dust-laying.

A WELL-MADE, LOW-PRICED MIXER
The literature of the Knickerbocker Co., 338 Liberty St., Jackson, Mich., describes in detail Wolverine mixers, especially made for use in the building field and in the construction of sidewalks, bridges and culverts where a well-made, low-priced mixer is needed.

TRUCKS FOR ROAD WORK
Whether it be road maintenance or construction, the motor truck has proved its value. Full information regarding the capacity and types of Winther trucks for this kind of work may be secured by writing to Winther Motors, Inc., Kenosha, Wis.

DEPENDABLE LIFTING-JACKS
Bulletin No. 29, issued by McKiernan-Terry Drill Co., 19 Park Row, New York City, describes in detail the Doughboy jack manufactured by this company in sizes from 15 to 100 tons.

HOISTING ENGINES AND PILE HAMMERS
Contractors interested in hoisting engines and pile hammers may secure valuable information and data from the catalogs of the National Hoisting Engine Co., Harrison, N. J.

CORRUGATED METAL CULVERTS
The advantages of genuine open-hearth iron corrugated culverts in both the round and half-round types are given in detail in the interesting illustrated free literature of the Newport Culvert Co., 542 West Tenth St., Newport, Ky.

PREVENTING WASTE IN ROAD MAINTENANCE
The booklet "Stanolind Paving Asphalt" containing full information regarding the penetration-method road, which stands up under heavy traffic, may be secured by writing to the Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill.

CONTRACTORS' EQUIPMENT
Catalog 69 issued by the Standard Scale and Supply Co., 1631 Liberty Ave., Pittsburgh, Pa., contains details regarding contractors' equipment which will be of interest to every contractor in the road and building field.

BUILDING ASPHALTIC CONCRETE ROADS
The Texaco asphaltic concrete booklet issued by the Asphalt Sales Department, The Texas Co., 17 Battery Pl., New York City, will be of interest to every road contractor who has asphaltic concrete contracts under way or in prospect.

STEAM POWER SHOVELS
Full information regarding Thew power shovels, which have a reputation for low maintenance, may be secured by writing to the Thew Shovel Co., Lorain, Ohio.

REINFORCING CONCRETE ROADS
The use of wire mesh for concrete road reinforcement is described in detail in literature which may be secured from the Truscon Steel Co., Youngstown, Ohio.

A DEPENDABLE LIGHT-WEIGHT MIXER
The Koehring Co., Milwaukee, Wis., will be glad to send a copy of its Dandie catalog No. D-6 to contractors interested in a light mixer of overstrength construction which is guaranteed to stand up under continuous service.

CARS, BATCH BOXES AND TRUCKS FOR ROAD BUILDING
Road catalog No. 100, issued by the Koppel Industrial Car & Equipment Co., Koppel, Pa., gives valuable information regarding the use of Koppel cars, batch boxes and trucks for concrete road construction.

ALL TYPES OF TAR AND ASPHALT HEATERS
The literature issued by Littleford Bros., 500 East Pearl St., Cincinnati, Ohio, describes its complete line of tar and asphalt heaters for paving contractors and municipalities.

CONVEYING-MACHINERY FOR CONTRACTORS
Contractors having conveying-machinery problems in road and building jobs should get in touch with the Weller Manufacturing Co., 1820-1856 North Kostner Ave., Chicago, Ill., as this company will be glad to send instructive catalogs describing its complete equipment for all kinds of conveying work.

A RUGGED ROAD CRANE
The catalog of the Byers Machine Co., 490 Sycamore St., Ravenna, Ohio, describes in detail the Byers Model 7 full revolving crane, which is claimed to be one of the most rugged road cranes built.

EXPANSION JOINTS SAVE CONTRACTORS' REPUTATIONS
The Waring-Underwood Co., Fernwood, Pa., will be glad to send literature describing its Ideal expansion joint, which is claimed to be the best method for providing for the expansion of improved pavements.

HYDRAULIC HOISTS FOR TRUCKS
Hydraulic hoists and bodies for fitting to new or old trucks for gravel work, coal handling, etc., are described in detail in the literature of the Heil Co., 1243 26th Ave., Milwaukee, Wis.

HIGH-EFFICIENCY ROCK DRILLS
The Denver Rock Drill Manufacturing Co., Denver, Col., will be glad to send complete descriptions and illustrated literature covering its Waugh rock drills, drill sharpeners and compressor outfits to any interested contractors.

A LOW-PRICED SCOOP BODY
Bulletin 32, issued by the Easton Car & Construction Co., Fulton and Church Sts., New York City, contains details covering the advantages of Easton scoop bodies for Ford trucks.

USED EQUIPMENT AVAILABLE
Very complete listings of used equipment for sale, rent or exchange may be secured by writing to the Searchlight Dept., McGraw-Hill Co., Inc., 475 Tenth Ave., New York City.

C. I. PIPE FOR ALL KINDS OF WORK
The advantages of Universal cast iron pipe for straight trench work, for tortuous and rough work in mountain districts, for emergency work, and for river crossings, is described in detail in the interesting illustrated literature of the Central Foundry Co., 90 West St., New York City.

TRACTORS FOR ANY JOB
A small tractor that can go where horses and trucks cannot go and will haul wagons, rocks, timber—in fact, anything the contractor needs to have hauled—is described in the literature of the Cleveland Tractor Co., 19211 Euclid Ave., Cleveland, Ohio.

TAR AND ASPHALT HEATERS
Reliable non-leakable welded tar and asphalt heaters from 10 to 1,000 gallons capacity are described in the illustrated literature of Connery & Co., Inc., 4000 North Second St., Philadelphia, Pa.

SECOND-HAND EQUIPMENT SPECIALS
The list of second-hand equipment for contracting work which may be secured from the Frank T. Craven Co., 46 Church St., New York City, may prove of interest and value to many contractors looking for used equipment.

GASOLINE INDUSTRIAL LOCOMOTIVES
Cummings gasoline industrial locomotives, which have proved their value and indispensability in both large and small road-building jobs, are described in detail in literature which may be secured from the Cummings Machine Co., Minster, Ohio.

FULL REVOLVING SHOVELS
Bulletin C-301-G, issued by the Bucyrus Co., South Milwaukee, Wis., describes in detail Bucyrus revolving shovels which can be equipped as shovels, draglines, cranes or clam-shell excavators.

STEAM AND MOTOR ROAD ROLLERS
Contractors desiring complete information regarding steam and motor road rollers should secure a copy of catalog A issued by the Buffalo-Springfield Roller Co., Springfield, Ohio, describing all its types and sizes of road rollers with and without scarifier attachment.

SPREADING STONE FROM TRUCKS
Complete information regarding the Burch stone spreader, which spreads stone evenly from the motor truck hauling it to the job, may be secured by writing to Dept. K-9, The Burch Plow Works Co., Crestline, Ohio.

THE DISINFECTION OF SEWAGE
Full information regarding the proper method of disinfecting sewage by the use of liquid chlorine, and its value in industrial and municipal communities, may be secured by writing to Wallace and Tiernan, Inc., Newark, N. J.

CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

Canadian Austin Machinery, Ltd.

The Austin Machinery Corporation, Chicago, Ill., has announced that the Canadian Austin Machinery, Ltd., Woodstock, Ontario, incorporated under the laws of Canada, will, in future, act as sole manufacturers and distributors in Canada of the complete Austin line of earth-moving and concrete-mixing equipment. The manufacture of Austin machinery in Woodstock, Ontario, enables the Canadian Austin Machinery, Ltd., to supply this broad line of ontractors' requirements for construction, good-road making, reclamation, excavation and irrigation promptly, and to furnish service in maintenance.

Redding Becomes Secretary of Massey Corporation

F. V. Shannon, Vice-President and Secretary to the Massey Concrete Products Corporation, Peoples Gas Building, Chicago, Ill., has resigned to accept another position. G. H. Redding has been elected Secretary of this and affiliated companies, the vice-presidency remaining vacant for the present. David A. Hultgren has been appointed Resident Manager at Chicago. Charles Gilman, 50 Church Street, New York City, is a Vice-President of the company and New York representative.

Bickel Becomes District Manager for Holt

W. A. Bickel has been appointed District Manager in charge of the consolidated territory of Iowa and Nebraska for the Holt Manufacturing Company, Peoria, Ill. Mr. Bickel has for the past year been District Manager in charge of the Des Moines branch, but will now make his headquarters at the Omaha branch, and the consolidated districts will include the states of Iowa, Nebraska and the southern part of South Dakota. The consolidation of the two territories under Mr. Bickel's management is a recognition of his success in the Iowa territory. His new address is 2429 Farnam Street, Omaha, Nebr.

Sheets Succeeds Bradt in Illinois

Following the resignation of S. E. Bradt as Superintendent of Highways, Illinois Department of Public Works, to devote his time to his private interests in De Kalb, Frank T. Sheets, until recently Engineer of Design in the Division of Highways, has been appointed Superintendent of Highways. The State Highway organization has already completed more than 1,200 miles of modern hard-surfaced pavement and is now engaged in finishing its connected system of state roads with a bond issue of $60,000,000.

A Reduction in Motor Truck Prices

In line with the recent reduction in material costs, the Standard Motor Truck Company, Detroit, Mich., has announced a substantial drop in the price of all its models. This company was one of the first truck manufacturers to announce a reduction from war-time prices on December 1, 1920. The present reductions average 15 per cent and have already resulted in improved sales conditions, in response to which production has been increased 25 per cent.

Turner to Engage in Private Consulting Practice

Daniel L. Turner, formerly Chief Engineer of the Transit Construction Commission, New York City, in charge of the design and construction of the subway system, associated for over 20 years with the development and construction of the New York subway system, and now Engineer to the New York Transit Commission, has announced that he will engage in private consulting practice, specializing in city transit work, in addition to his present duties with the Commission.

The Pittman-Smith Engineering Company

E. W. Pittman and H. T. Smith, formerly General Manager and Chief Engineer, respectively, for the engineering works of the Dravo Contracting Company, have organized the Pittman-Smith Engineering Company, Pittsburgh, Pa., to engage in the design of power-plants, machinery layout, and all types of industrial buildings.

Dam and Reservoir Survey

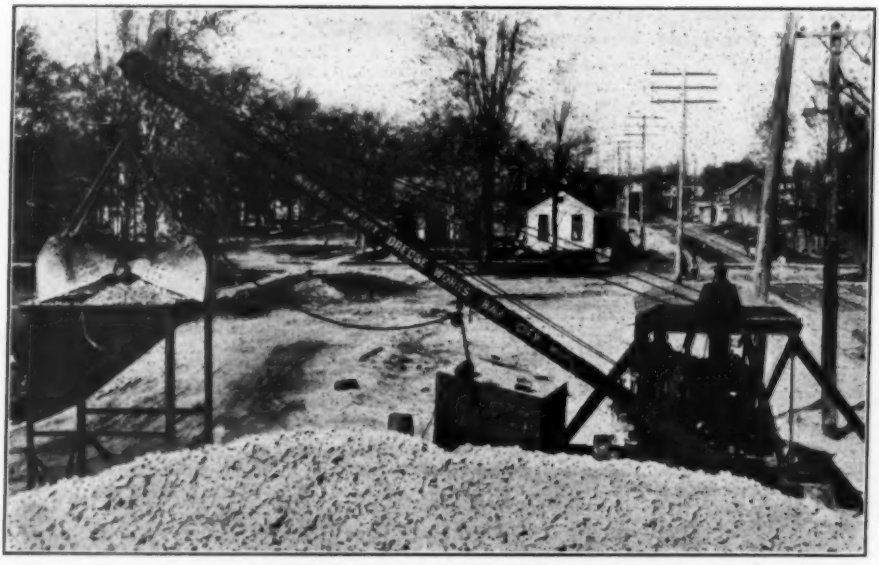
The Holway Engineering Company of Tulsa, Okla., with J. D. Trammel, of Fort Worth, Tex., have been engaged as engineers to submit a report and estimate on the cost of a dam and reservoir on Spavinaw Creek and a 65-mile pipe line to furnish a new water-supply for Tulsa, Okla. The survey is already fully under way and progressing rapidly.

Cement Prices Come Down

The Universal Portland Cement Company, 210 South La Salle Street, Chicago, Ill., has announced a reduction in its selling prices for Universal Portland cement, effective September 15, of 20 cents per barrel at its Chicago plant and 15 cents a barrel at its Pittsburgh and Duluth plants. This is the second price reduction made by this company this year.

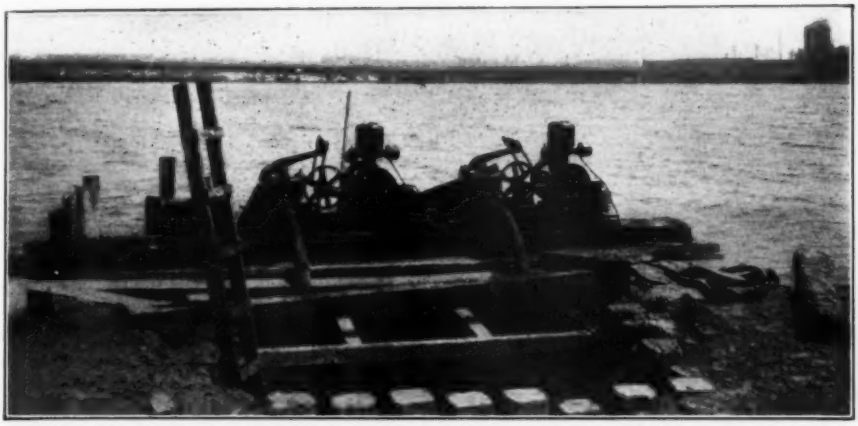
Motor Contracting Equipment

A GMC TRUCK ON ROAD WORK HAULING AGGREGATE FOR CONCRETE MIXER



A BAY CITY CRANE, OPERATED BY OIL ENGINE, WITH CLAM-SHELL BUCKET FILLING RAPID-LOADING BIN FOR MOTOR TRUCKS

A FLEET OF WHITE TRUCKS OPERATING IN A WATER-FRONT DEVELOPMENT PROJECT NEAR SAN FRANCISCO, CALIF.



GOULDS DIAPHRAM PUMPS OPERATED BY NOVO ENGINES, UNWATERING A CAISSON NEAR THE SHORE

C. A. WILSON, OF INDIANAPOLIS, IND., USES THIS BATES STEEL MULE WITH THREE ¾-YARD ROYTRAC WHEEL SCRAPERS IN SHALE

The average load per ½-mile trip is 2 yards, and it takes 9 minutes for the trip. To do this same work with horses would require nine 3-horse scrapers and one snatch team. This gives a total of 10 teams and 10 drivers, making the cost of operation about 3 times as great as for the above outfit

Legal Decisions in the Contracting Field

Edited by A. L. H. Street, Attorney-at-Law

Interest of Labor and Material Claimants in Construction Fund

A contract for the construction of a state highway did not require the state to retain part of the price as a trust fund for the benefit of those to whom the contractor was indebted for labor and material, but enabled the state in taking over the work to use money retained for such purpose. This is the gist of the recent decision of the Washington Supreme Court in the case of Beyer vs. Zindorf, 198 Pacific Reporter, 977.

Under paragraph 7 of the contract involved it was provided that the contractor should receive monthly payments covering not more than 80 per cent of work done during the preceding month, on estimate of the State Highway Commissioner. Final payments were to be made within 30 days after the completion and acceptance of the work. It was further provided, however, that the State Highway Commissioner might require the contractor to show, before the making of such final payment, that all just debts due laborers, materialmen, etc., had been paid; and that, on notice from such claimants against the contractor, the Commissioner might retain amounts in addition to the 20 per cent to be covered in the final settlement. Interpreting this contract, the Supreme Court says:

"Taking the contract as a whole, and giving it the interpretation which would best effect the intention of the parties, it will be seen that the contract contemplated the use by the State Highway Commissioner of all amounts allowed by the contractor and not paid to him in carrying out the contract, in the event the State Highway Commissioner was forced to complete the work."

The Court refers to a similar case previously before it in which the contract provided that the city of Seattle might withhold any and all payments accruing under a construction contract until satisfied that wage and material claims, etc., had been fully paid by the contractor. Quoting from this case, the Court says:

"It is true that the city, by virtue of a provision of the agreement which we have hereinbefore noted, might have withheld all payments from the contractor until it was satisfied that all just claims for labor and material had been fully paid; but it does not follow from that fact that it was obliged to do so, and that, having done otherwise, it should now be held to be a trustee of the laborers and materialmen, and, as such, liable to them directly for the amount of the fund assigned and of the bond delivered to the contractor."

Limitation of Liability as to Public Work

There is a general principle of law recognized by all courts, to the effect that one who contracts with municipal or other public authorities is chargeable with knowledge that there is no right on the part of such authorities to contract liability in excess of appropriations provided for the work in hand.

A Federal court, however, justly rules in the recent case of Bates & Rogers Construction Company vs. Board of County Commissioners of Cuyahoga County, Ohio, that this principle does not apply to liability incurred by a public corporation to a contractor by reason of a default on the part of the corporation. The ruling is to the effect that if a city, county or other similar public corporation causes damage to the contractor by breach of the contract, e. g., failure to deliver the site for commencement of the contract work within a specified time, or within a reasonable time in the absence of express agreement on a time, there may be recovery for such damage, although the recovery plus the contract cost of the work may involve more money than has been appropriated for the construction of the improvement.

Statutory and constitutional debt limits imposed against public corporations refer to contract indebtedness and not to liability for wrongs committed against others. (28 Cyc., 1545.)

Modern Practice in Paving Joints

IN the modern practice of handling construction work, the attempt is made to eliminate all unnecessary minor details and to reduce to a standard as many operations as possible, thereby making for speed and economy in carrying the contract to completion. In the construction of pavements and improved roadways there are a great many minor details to be considered and among them is the important matter of provision against damage due to expansion in the completed pavement.

A STREET WELL PROTECTED WITH INTEGRAL EXPANSION JOINTS

It has been the practice to provide in some sort of way for this expansion, but the method used was more or less costly and caused considerable waste in raw material, while failing to give the desired amount of protection on account of the uncertainty that joints were properly filled with the bituminous material. The former method required the investment in transportation and installation of a heating equipment, consisting of melting furnace, dippers and pouring pots. Also provision had to be made for fuel and a supply of bituminous material and for wooden strips to be placed in the pavement, these strips being quite expensive when made up to proper section. In order to operate this small expansion joint plant from three to six men were required. The raw material could only be roughly estimated, as one piece of work would require more or less than a similar piece of work, depending on the amount of material wasted. At the end of a job either there would be a shortage of material, causing delay until an additional supply could be received, or there would be a surplus which had to be rehandled and shipped to some other job, or else sold.

All of these features made this item in paving construction a very annoying one to the man in charge of the work, and while provision was made for expansion, it was not a scientific method of handling this part of the work. The Waring-Underwood Co., Fernwood, Pa., has placed on the market a premolded expansion joint strip which has practically eliminated all of the numerous irritating details noted above and has standardized the practice of providing for expansion in pavements and roadways. The premolded strip is prepared ready for use and is placed in the pavement by the pavers, coincident with their regular work, completing this item in one operation and leaving no doubt as to the proper provision for expansion. The specifications of the National Paving Brick Manufacturers Association, which are the standard for brick paving, call for a premolded type of expansion joint.

The particular advantages of the Ideal expansion joint, manufactured by the Waring-Underwood Company, Fernwood, Philadelphia, Pa., are: (1) it is easy to install and saves the investment in heating equipment, pouring pots, wooden strips and labor required when the pouring method is followed; (2) the joint strip is laid as the pavement progresses and there is nothing to require going back over the work to fill joints after grouting has been

finished; (3) it insures an expansion joint, as there is no chance of foreign matter getting into the space which should be completely filled up by the "joint filler"; (4) it makes a cleaner and better job than the old method and effects a saving in the cost of the work; (5) the joint can be inspected before being placed; (6) the cost can be definitely estimated and an exact quantity ordered.

The Ideal expansion joint has a predetermined melting point, making it safe to use in the hottest season of the year and its general rubbery consistency makes it an acceptable material for the purposes noted. In order to reduce the labor of handling and installing to a minimum, the length of the strip has been standardized at 5 feet and the shipping package at 320 to 350 pounds. This length of strip and weight of package have been found by experience to be best suited to ordinary conditions.

For longitudinal joints in streets 12 to 20 feet wide, ½-inch joint is used; from 20 to 30 feet wide, ¾-inch; from 30 to 40 feet, 1-inch; from 40-50 feet, 1¼-inch; over 50 feet wide, 1½-inch. For transverse joints in concrete roads, ¼ to ½-inch joint is placed every 30 feet. In streets having car tracks a ½-inch joint is placed on each side of the rail. At manholes and water boxes, a ½-inch joint should be placed around the casting to insure against expansion damages.

Trailers Turn Hauling Job from Loss to Profit

THE value of trailers to a contractor in hauling gravel and stone is most forcefully brought home by the case of a Detroit contractor who in 1920 had his bid accepted for hauling gravel for the Oakland County Road, Detroit, Mich. With a good truck it cost him $1.60 per cubic yard to handle the stone on a 12-mile haul in 1920, and at this rate his income was only about $6 a day more than the actual cost of operation of the truck, which, of course, did not make the hauling a paying proposition.

In 1921, the same contractor invested in a Detroit trailer to use with his truck. He loads 5 cubic yards on the truck as he did last year, but he also loads an additional 5 cubic yards on the trailer. The haul this year is 19 instead of 12 miles and it costs him only $1.20 per cubic yard to handle the material. In this way the contractor's total income is from $91 to $96 per day, $50 of which is clear profit, over and above all his expenses, including depreciation and other charges against both trailer and truck.

BOTH TRUCK AND TRAILER HAUL 5 CUBIC YARDS OF STONE AT A PROFIT, WHILE THE TRUCK ALONE LAST YEAR LOST MONEY

The Manufacture and Laying of Concrete Pipe

PLAIN concrete sewer pipe is usually manufactured by machines in standard sizes ranging from 4 inches to 42 inches internal diameter. Concrete of semi-dry consistency is used, which is thoroughly compacted in molds under pressure. The correct consistency has been obtained when web-like markings appear on the outer surface of the pipe upon removal from the mold. After removal from the mold, the pipes are placed in a saturated steam or water-spray curing room for a sufficient period to insure strength and low absorption.

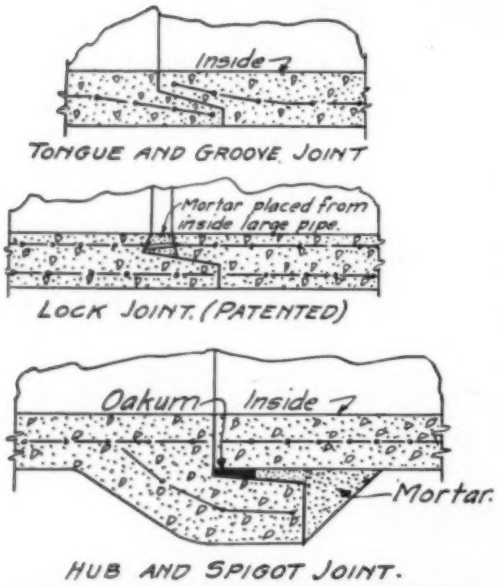
Machine-made concrete pipe is of true cylindrical form with a smooth interior surface and offers many advantages for house connections, main lateral sewers and intercepting sewers. All necessary bends, Y's and other specials of the same quality can be secured wherever concrete pipe is made.

Reinforced concrete pipe is made in standard internal diameters of from 12 to 108 inches and in length from 2½ to 6 feet. The types of joints commonly used are illustrated herewith. There are three methods of placing the reinforcement in the pipe, known as the single line reinforcement which is placed nearer the internal ring, the double line reinforcement which has a line placed both near the inner and outer surface of the pipe and elliptical reinforcing in which the steel is nearer the inner ring at the top and bottom and nearer the outer ring at the sides.

The American Society for Testing Materials adopted standard specifications for plain concrete sewer pipe in June, 1920, which have met with general satisfaction and which should be followed by engineers wherever pipe of this type is to be used.

WEB-LIKE MARKINGS ON CONCRETE PIPE AFTER REMOVAL OF MOLDS, SHOWING THAT THE CORRECT AMOUNT OF WATER WAS USED IN MANUFACTURE

Concrete pipe, both plain and reinforced, is now being used extensively in all parts of the country for building storm and sanitary sewers. It is not definitely known how early concrete pipe was used for this purpose, but such records as are available indicate that they have been giving excellent service since 1873 in many parts of the United States. From the rapid increase in the amount of concrete sewer pipe laid it is evident that in the opinion of leading municipal engineers its strength and enduring qualities compare favorably with those of other types. The early use of concrete pipe was in sewers of larger diameter. In later years improvements in concrete pipe making machinery have made possible the successful manufacture of small sizes which are now equally well received by sewer engineers. Concrete pipe is now made in standard sizes from 4 inches up to 108 inches internal diameter. It is capable of sustaining the weight of heavy fill and



THREE TYPES OF JOINTS COMMONLY USED IN REINFORCED CONCRETE PIPE SEWER CONSTRUCTION

deep trenches or the loads caused by the passage of heavy vehicles where the sewer is near the surface. Due to its practical impermeability, concrete sewer pipe greatly reduces leakage and filtration.

Sewer Construction Methods

The recommended practice for laying sewer pipe, adopted by the American Society for Testing Materials in 1919, should be closely followed by contractors in order to insure the best results. The following extracts are pertinent:

"The foundations in the trench should be formed to prevent any subsequent settlement and thereby possibly an excessive pressure and consequent rupture of the pipe.

"If the foundation is rough, an equalizing bed of concrete or sand well compacted should be placed upon the rock. The thickness of these beds should be not less than 4 inches. Pipe should be laid in these beds so that at least the lower third of each pipe is supported its entire length.

"If the foundation is good firm earth, the earth should be pared or molded to give a full support to the lower third of each pipe, and, if necessary, to secure a proper bearing for the pipe, a layer of concrete, fine gravel, or other suitable material should be placed. The same means of securing a firm foundation should be adopted in case the excavation has been made deeper than necessary.

"If there is no good natural foundation, the pipe should be laid in concrete cradle supported on a masonry foundation carried to a soil of satisfactory bearing power or supported on a structure designed to carry the weight of pipe and its load to a firm bearing.

"Trenches should be kept free from water until the material in the joints and masonry has sufficiently hardened.

"To protect pipe lines from unusual stresses, all work should preferably be done in open trenches.

"Pipe lines should be placed at a sufficient depth below the surface of the street to avoid dangerous pressure or impact. When this is not possible special reinforcement should be provided.

"Trenches should be only of sufficient width to provide a free working space on each side of the pipe, preferably not over one-third of the nominal diameter, and never less than 4 inches, according to the size of the pipe and the character of the ground. In any case there should be sufficient space between the pipe and the sides of the trench to make it possible to thoroughly ram the back-filling around the pipe and to secure tight joints.

"The laying of pipe in finished trenches should commence at the lowest point so that the spigot ends point in the direction of the flow.

"All pipe should be laid with ends abutting and true to line and grade. They should be fitted and matched, so that when laid in the work they will form a sewer with a smooth and uniform invert.

"It is necessary to use all possible care when shoving the pipe together so that the joints will not be unnecessarily large.

"Sockets should be carefully cleaned before pipe is lowered into the trenches. The pipe should be so lowered as to avoid unnecessary handling in the trench.

"The pipe should be set firmly to line and grade and the joints carefully adjusted and filled with the joining material.

"Joints should be made in the following manner: A closely twisted hemp or oakum gasket of suitable diameter, in no case less than ¾ inches and in one piece of sufficient length to pass around the pipe and lap at the top, should be solidly rammed into the annular spaces between the pipe with a suitable caulking tool. When cement joints are used, the gasket should be first saturated with neat cement grout. The remainder of the space should then be filled with the jointing materials.

"All trenches and excavations should be backfilled immediately after the pipe is laid therein, unless other protection of the pipe line is directed. The backfilling material should be selected and deposited with special reference to the future safety of the pipe. Clean earth, sand or rock dust should be solidly

THIS REINFORCED CONCRETE TRESTLE, 30 FEET HIGH, WAS ERECTED TO MAINTAIN A UNIFORM GRADIENT ON THE CONCRETE SEWER AT COLUMBIA, S. C.

tamped around the pipe to a level at least 2 feet above the top of the pipe. This material should be carefully deposited in uniform layers. Unless otherwise permitted, each layer should be carefully and solidly tamped or rammed with proper tools, so as not to injure or disturb the pipe line.

"Puddling or water flooding for consolidating the backfilling is recommended only for sandy and gravelly materials. If this method is used the first flooding should be applied after the backfilling has been compacted by tamping up to 2 feet above the top of the pipe and the second flooding during or after the subsequent filling of the trench. An excess of water should be avoided in order to prevent the disturbance of the earth under and around the pipe and also to prevent an undue excess of pressure upon it.

"Working or walking on the completed sewer, except as may be necessary in tamping or backfilling, should not be permitted until the trench has been backfilled to a height at least 2 feet above the pipe.

"The filling of the trench should be carried on simultaneously at both sides of the pipe in such a manner that injurious side pressures do not occur."

Saving the Roads

A FEATURE of overloading motor trucks should be borne in mind for the general welfare. While no one claims that all roads are everything that they should be, still they must be accepted and used for what they are until better roads can be built. Some states have begun to realize that overloading of trucks is damaging to roads and bridges, and their authorities are seeking a remedy. California is systematically weighing loaded trucks on the roads in an effort to prevent overloading and the consequent damage to roads.

It will be remembered that the Kentucky Legislature of 1920, acting along similar lines of reasoning, had before it a very drastic bill which would have placed very arbitrary limitations on the use of public roads by trucks. This bill was fortunately not passed as originally drawn, but its appearance should be considered a warning, and truck owners should remove any cause for its reappearance, as well as put money in their own pockets, by carefully supervising the loading and operation of their machines.

Overloading is a most disastrous abuse to a motor truck. Truck abuse, whether it be overloading or anything else, is a grievous offense against business, because it blocks the progress of transportation.

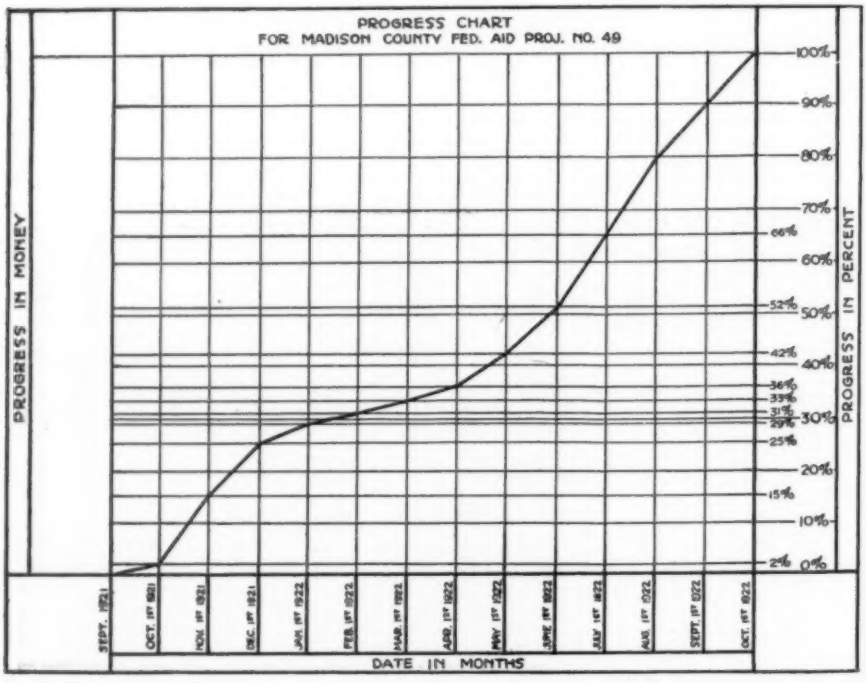
"THE ROCKY ROAD TO DUBLIN"

State Highway Department Adopts Progress Chart as Part of Contract

THE State Highway Department of Kentucky has recently sent out two general notices on contracts and extension of time limits for the information of contractors on state highway work. They embody full instructions regarding the new scheme of the Department for the inclusion of a progress chart as a part of the contract for every state highway job in the future. They also take up the question of the extension of the time limit on contracts. In future, any request for an extension of the time limit on a contract must be filed at the office of the State Highway Engineer, as a formal application, giving reasons for the extension, accompanied by the written permission of either the bondsmen or the surety company. If the cause is just, the Department will undoubtedly grant it; otherwise, not.

The Department has advised all contractors that after the expiration of the date specified in his contract, if no extension has been granted, there will be no payment of a monthly estimate. This is based on the fact that the Federal Government does not reimburse the state for half the cost of the monthly estimate after the expiration of the time limit of the contract unless the state office has granted an extension.

In the future, in all contracts awarded by the State Highway Engineer a reasonable time limit will be given, specifying a date for the full completion of the contract. To each contract there will be attached a progress chart, compiled by the engineers of the State Highway Department, and based on average conditions, showing the anticipated progress and volume of work for each month. No monthly estimate or payment



CHARTS OF THIS TYPE ARE NOW INTEGRAL PARTS OF ALL KENTUCKY STATE HIGHWAY CONTRACTS

will be given the contractor unless the progress shown by the chart is adhered to. The Secretary of the Kentucky Association of Highway Contractors in the interesting house organ of that organization, *The Scraper,* states that he has taken the matter up with W. N. Bosler, Road Engineer of the State Highway Department, who says that the progress chart will specify a definite percentage of the whole contract to be completed at stated intervals and will not refer to any particular subdivision of the work. The chart will be effective from the date of the contract, and in the event an extension of time for completion is granted, a corresponding revision will be made in the progress chart.

Mr. Bosler says that it is not the intention to be severe in this progress chart as regards time for completion, and he is sure that the time allowance will be ample in all cases. A copy of the chart of each contract is to be on file at the State Highway Department's office at Frankfort, Ky., prior to the letting, where it may be examined by prospective bidders.

Safety First Signs Prevent Accidents

They Are Worthy of Serious Consideration on All Jobs

IN accident prevention work, especially, signs productive of results must needs be something more than a mere jumble of words on a steel plate. They should be attention-arresting—have a punch—be standard as to design, color, wording, etc. Statistical authorities state that 90 per cent of accidents are due to carelessness, ignorance or criminal negligence. Educational means must be used to eliminate the moral hazards of fire and accidents. Means and measures that reach the greatest number are through the medium of signs—signs that speak authoritatively, signs that arrest the attention and insist on carefulness.

Somewhere in this world there is probably somebody who can tell how many words there are in the Chinese language, but no one in the world could tell how many different kinds of danger there are in American industrial life. Don't use a danger sign unless a danger really exists, but when you do use one, specify either what the danger is, where it is, or what to do to avoid the danger. Mark powder magazines, "Danger—Explosives," a live wire, "Danger—Live Wire," a high-tension line, "Danger—High Voltage," blasting points, "Danger—Blasting—Keep Away." Local conditions must be met, but meet them intelligently. In law, a danger indicated but not specified is regarded as not indicated.

IN BRILLIANT RED, THIS SIGN MAKES THE CARELESS TAKE HEED

The Stonehouse Steel Sign Co., Denver, Colo., manufactures a very complete set of standard signs, tags and bulletin boards which are approved by some of the biggest safety engineers, leading accident and liability insurance companies, and workmen's compensation boards, and are used by general, building and other contractors throughout the country. The illustration shown herewith gives a slight idea of the clearness and striking character of these signs. If it were possible to print this illustration in color, its value would be much more apparent. The catalog of the Stonehouse Steel Sign Co. shows all its signs in color, which makes a very striking and forceful piece of literature for the contractor to look over when he is deciding what signs it is to his advantage to use to reduce or eliminate accidents in the work he has under way.

Investment in Engineering Lasts Forever

I want to say a word right here for engineers. All honor to these men. They are the men who are using money where it will help not simply you and me for a few days or for a few weeks, but where it will help posterity. Why? Because a dollar spent to-day on a lunch lasts five hours; a dollar spent for a necktie lasts five weeks; a dollar spent for a cap lasts five months; a dollar spent for an automobile lasts five years; a dollar spent on the building of a house or the erection of an office building or factory lasts twenty-five, or more, years; but a dollar given to engineers and used by them in the elimination of a railroad grade, or the straightening of a highway, or the development of a water-power, lasts for eternity.—Roger W. Babson, in *Professional Engineer,* October, 1921.

Wetness versus Fatness

A Discussion of the Use of Lime in Mortars

EVERY brick-mason knows that lime gives to mortar a quality that no amount of water or cement can give —"fatness." This quality is desired both because it makes the work easier, and because it makes better work. It also gives strength to the structure because the brick are better bedded, and the passage of fire or air through the wall is prevented for the same reason. Fat mortar is so important to the bricklayer, that more than one strike has occurred when other mortars were specified, and, in fact, the desirable properties of lime are such that it is a rare case where some lime is not used, even though the specifications call for other materials.

Fatness is still more important in concrete, for sandstone and cement are naturally very short, harsh, rough and hard to handle. Concrete must be dumped clean from the mixer, conveyed in buckets, buggies or barrows, and sometimes in chutes or trucks for long distances, without separating or "segregating." It must then flow into narrow forms, around steel bars in complicated mats, electric conduits, odd-shaped frames and sharp corners, all without leaving stone pockets or bubbles, and must show a smooth surface when the forms are removed.

In all parts of the country, practical men tell us that hydrated lime added to the cement improves concrete at all these points, and its use for this purpose consequently has grown rapidly. But this quality of "workability," so much desired and sought after, has never been defined or measured. Many attempts have been made to measure it, such as the slump tests, the flow table, and the angle of flow in chutes, but each has a fatal defect, namely, that any desired reading can be secured by adding water. However, segregation is increased, strength is reduced, and fatness is not gained by addition of water.

The recent tests by Professor Abrams of Lewis Institute, which are being widely advertised by the Portland Cement Association, are the most pretentious series ever run on the effect of hydrated lime in concrete. They purport to eliminate all the variables except strength, and measure that. The tests may be divided into two groups—hydrated lime added dry, and hydrated lime added with water. In the case of dry additions, the strength is greatly increased, but the results are dismissed by Professor Abrams with the statement that the consistency was changed, the batch being too dry to work.

That strength can be increased in this way is evidenced by the following statement of Colonel H. C. Boyden, expert lecturer for the Portland Cement Association:

"The use of more cement [than the ideal amount] in a batch does not produce any beneficial effect, except from the fact that a plastic, workable mix can be produced with a lower water-ratio. The reason that a rich mixture gives a higher strength than a leaner one is not that more cement is used, but because the concrete can be mixed with a water-ratio which is relatively lower for the richer mixture than for the lean one. If advantage is not taken of this possibility of reducing the water-ratio, the additional cement in the richer mixture is wasted."

When both water and hydrated lime were added, the workability was much improved, but this fact is not made plain. The water allowance was proportioned by the Vicat needle test for normal consistency. This, however, reveals nothing as to workability. Neat lime specimens reading the same by the needle may vary extremely in workability themselves and have widely different effects in this respect on the concrete to which they are added. In short, consistency, which the Vicat needle measures, is entirely different from "fatness."

Further on, the author reports figures which he maintains are an index of "plasticity" in concrete. In the Abrams tests, concrete of unit consistency is defined as that which slumps ½-inch to 1-inch in a cylinder 6 inches in diameter and 12 inches high, but the very first group of five specimens slumped an average of 6.2 inches, and the whole result of the slump tests, when plotted graphically, looks like a crazy quilt, having no rational trend whatsoever.

Save YOUR Roads

A dusty road is proof that the road is wearing away.

Standard Asphalt Road Oil properly applied prevents dust. It also saves the surface by binding it and making it water proof. By saving the surface you save the whole road.

The above illustration of a country road was taken immediately after an almost continuous rain fall of two weeks.

One application of

No. 4 STANDARD ASPHALT ROAD OIL

saved this road.

Our book, "Standard Road Oil," describing the different grades and proper methods of applying road oil to all types of roads, sent free on request.

STANDARD OIL COMPANY
(INDIANA)

910 So. Michigan Ave. Chicago, Ill.

The American Society for Testing Materials has abandoned this form of cylinder and adopted one with a ½-inch taper; but while this will eliminate some of the minor objections to the test, the most important one remains, namely, it does not measure the right property, the one in which concrete men are interested.

The Portland Cement Association attempts to support these contentions with the tests of Professor H. H. Scofield of Cornell University. He states in his report, however, "The degree of wetness in mixing was medium and judged by the eye in each case, being constant for all mixes. No attention was paid to workability or water-ratio at the time of mixing the mortars."

"Workability" is the best word yet devised for the desired property, for "plasticity" and "flowability" cover only part of the meaning, while "consistency" refers only to "apparent wetness;" but "workability," like "strength," has a wide application. "Strength" may mean compression, tension, torsion, shear, bending, or other combinations. In the same way "workability" includes easy dumping from the mixer, bucket, hopper or buggy, proper flow down a chute, around reinforcing and other obstructions into complicated forms and sharp corners, freedom from segregation, and from stone or water pockets, easy tamping and easy finishing under the machine or trowel. Up to the present time this quality has been one of those which are said to be incapable of expression in English, but "one must feel it with his tool."

This attitude, however, is destructive of progress, and we can never advance unless we make the attempt to define and measure these variables, however elusive they may be. Here is a problem worthy of the finest minds in concrete engineering, and it should attract the eager hunter of new truth. I mean that what is wanted is not support for some pet theory, or advertising for some material, but the whole truth, irrespective of its effect on any material; for only the truth can benefit the public at large, and in the end it is certain that the scientific facts will govern the practice to which manufacturers must conform.

Let us then continue the effort to define and measure "fatness" in concrete, knowing that what is common knowledge among the trade must sometime yield to scientific investigation, and that the knowledge then secured will be of inestimable value to industry.

How They Succeed

The Working Formula of a Well-Known Contractor

WHAT are the most important influences in the work of a successful firm of general contractors?

Henry W. Horst and his company at Rock Island, Ill., attribute the success of the company to the following:

Absolute knowledge of every detail of the construction business.

Experience gained over a term of twenty-five years of actual contracting business, not only through local and general operations, but through extensive studies throughout the United States as well as European countries, and then adopting the best and most efficient methods.

Thorough organization of loyal forces, gathered and retained, and employing not only real men developed in the field, but also high-grade college graduates from our own and foreign countries.

Establishing thorough credit.

Location of home office in large, permanent and attractive business block of our own.

Recognizing the fact that time is the essence of every contract.

Never being behind, but endeavoring always to lead in the use of the most up-to-date machinery and equipment.

Securing the most efficient service from employes, not only by paying the highest wages, but interesting them in being part-owners of the company, as well as other inducements.

Winther Trucks Maintain County Roads

The excellence of Kenosha County highways is due, in large measure, to Winther hauling service.

Summer and winter, you can see this 3½-ton Winther pulling heavy loads of gravel from the pit, distributing cement, sand, and ashes, or transporting "fill-in" material to outlying points of the county.

Dependability is the keynote of its service.

"But in spite of this strenuous hauling" says Commissioner Herzog, "our Winther has cost us practically nothing. $14.44 represents its total repair bills for the past year. Fuel and lubricating expenses have been in the same moderate proportion."

Such consistency and economy in operation is characteristic of Winther trucks. It enables contractors to handle their work surely and profitably.

Write us about your hauling requirements; let us tell you which capacity and type of Winther truck is best suited to your needs.

There is a size and type of Winther for every trucking need. Write us to-day for literature and prices.

WINTHER MOTOR TRUCKS

WINTHER MOTORS, Inc.

Manufacturers of Motor Trucks and Motor Cars

Kenosha, Wis.

WINTHER TRUCKS

Complete Rock-Crushing and Screening Plant

Portability an Important Feature of Interest to Road Contractors

PORTABILITY is one of the necessary characteristics of a highway contractor's outfit. He has a job in this county the first of the construction season and in another county toward the end. He takes on a contract for 12 miles of road and wants to move his plant from one end to the other to expedite the work and cut down hauling costs. With this in mind the Universal Road Machinery Company, Kingston, N. Y., has developed a complete portable rock-crushing and screening plant which is illustrated herewith in the process of moving and in operation.

The Reliance portable crusher is mounted on a short coupled wheel truck with large wide-tired wheels, having roller bearings. The steel "goose-necks" give ample clearance for turning the front wheels under the truck, rendering it easy to make the shortest possible turn. The rear axle of the truck being bolted to the frame eliminates the vibration so common in crushers mounted on long beams, and facilitates to a marked degree the convenience of handling the machine in restricted places. The crusher is well balanced, so that at full speed its operation is smooth and easy, reducing its vibration to a point where it is more like a permanent installation than like the usual portable crushing outfit.

The folding elevator attached to the portable rig is very convenient and practicable. A convenient crank enables one man to raise the elevator from its horizontal position occupied while being transported to its working position. The raising of the elevator automatically and simultaneously places the lower portion into position to receive the stone from the crusher chute. By reversing the crank the elevator is lowered into position for transportation and at the same time the lower part is raised clear of all road obstructions.

It is claimed that the Reliance crusher is built closer to the ground, size for size, than any other portable crusher. This is an important feature, as the additional work of lifting the stone from the ground, even a few inches higher than necessary, is a real factor in the amount and cost of production.

The complete portable outfit includes the crusher and elevator as well as the screen and bin. With a plant of this type the contractor is independent of railroads and trolley companies for his crushed stone supply, and can save money on the cost of the material and the cost of getting the material onto the job. The portable bins are made in sizes from 12 to 40 tons capacity, and may be loaded and transported on railway cars without knocking down or taking apart.

The frame is mortised and tenoned and held together with bolts and tie rods. The design is such, and the bracing so thorough, as to prevent sagging, bulging or loose joints. The floor is lined with sheet steel, and the equipment includes discharge chutes, tongue, whiffletrees and a large tool box.

The screen and screen frame in the Reliance bin are arranged to drop down into the interior, thus lowering the center of gravity of the outfit and allowing the rig to pass under low wires, bridges and other construction. The lowering and raising of the screen is accomplished by means of a cable hoist, operated by a crank, worm and worm gear. It is a simple, convenient and easily operated arrangement. It has the further advantage of placing all the mechanism entirely out of the way and protecting it from dirt and weather.

All bins are built high enough to discharge into motor trucks.

Special Screening Plants

The old way of preparing sand and gravel for the market by hand, screening it through flat screens, has become obsolete and impractical in these days of keen competition. The natural resort, of course, is to power screening plants, but the varying conditions existant at different gravel banks makes it necessary, in many cases, to design special outfits in order to obtain the best results.

The Universal Road Machinery Company has built a special screening plant designed to reduce the cost of hand and gravel screening. In this outfit the elevator is the steel frame telescoping type for portability, and the whole apparatus is mounted on wheels. Power is supplied by a gasoline motor placed under the bin, out of the way and protected from the dirt and weather. Gravel and sand is simply broken down with shovels and is automatically picked up by the elevator, screened and stored in the different pockets of the bin, ready to load by gravity into the small cars or trucks used for its transportation to the road or building job.

The Foundation of Contracting

Ordinary business prudence requires that the contractor be one who knows his business, that his bid be reasonable, his equipment sufficient and his finances and integrity sound.

METERS

The Trident Enclosed Gear Train Fits The Old Style Main Casing

Any Water Department combating conditions of corrosion, clogging or extreme wear, may adapt their present Tridents, in the specified sizes, to the new type by simply purchasing and installing the new type of gear train unit.

This means REAL INTERCHANGEABILITY—with every Trident Meter we have ever made in these sizes.

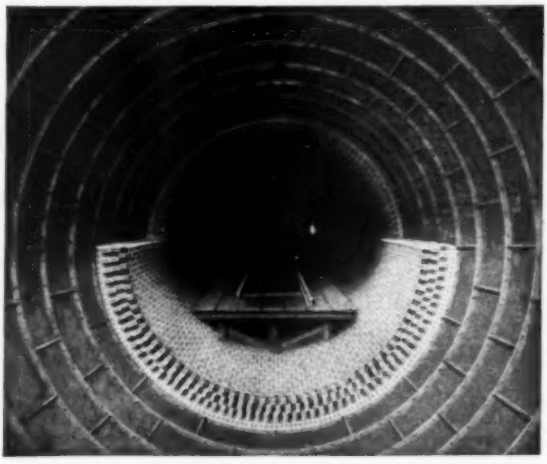
NEPTUNE METER Co
50 E. 42ND ST.
NEW YORK

Tunnel Liner Plates for Sewer Construction

THE modern method of tunnelling under ground is to use pressed steel liner plates to support the earth. The Truscon Steel Company, Youngstown, Ohio, has developed the Truscon tunnel liner plate, which consists of flanged sections bolted together, making a continuous rigid shell which can be carried forward a considerable distance in advance of the masonry. These plates are equally satisfactory used with either brick or concrete and make it easily possible to use removable steel forms for the inner surface of the tunnel.

Safety to workers is assured by providing this rigid steel lining. It is convenient and economical and effects considerable saving in shoring because of the small-sized sections and the rigid continuity secured by bolting them together. The entire construction is speeded up because of the simplicity in using the plates and the fact that tunnelers can keep in advance of the construction forces.

Every day saved in such construction work means a considerable financial saving to the contractor and to the city government.



TUNNEL LINER PLATES, SEVEN-MILE ROAD AND GRATIOT AVENUE SEWERS, DETROIT, MICH. THE OUTSIDE DIAMETER OF THE SEWERS IS 12 FEET TO 13 FEET 8 INCHES

Wages, Here and Abroad

THE following comparative rates of wages in the United States and in foreign countries was recently prepared for the Committee on Ways and Means of the House of Representatives:

[In dollars per day figured at the rate of exchange prevailing for the year shown.]

	United States	Germany	Japan	England	France	Spain	Austria
Bricklayers:							
1913.....	$5.49	....	$0.62	$1.80	$1.54	....	....
1914.....	5.59	$0.99	.55	1.72	....	....	....
1919.....	7.02	.43	1.40	....	....	$1.54	....
1920.....	9.60	.82	1.75	3.29	1.41	....	$0.55
Laborers:							
1913.....	2.47	....	.29	....	....	....	....
1914.....	2.50	.81	.28	1.09	....	....	....
1919.....	3.86	.41	1.00	....	....	....	....
1920.....	5.58	....	1.25	2.83	1.06	....	.53
Carpenters:							
1913.....	4.24	....	.45	1.80	....	....	....
1914.....	4.33	.99	.43	1.58	....	....	....
1919.....	6.19	.42	1.10	....	....	1.35	....
1920.....	8.27	....	1.40	3.23	1.54	2.05	.55
Painters:							
1913.....	4.04	....	.60	1.70	1.43	....	....
1914.....	4.16	.92	....	1.47	....	....	....
1919.....	6.10	.42	1.25	....	....	1.54	....
1920.....	8.33	.71	1.65	3.19	1.54	1.23	.45
Plasterers:							
1913.....	5.39	....	.48	1.70	....	....	....
1914.....	5.44	....	....	1.62	....	....	....
1919.....	7.06	....	1.25	....	....	1.74	....
1920.....	9.22	....	1.75	3.29	1.54	....	.64

EXPLANATORY NOTE

United States.—Average rates for United States in May of each year. (*Monthly Labor Review,* April, 1921.)

Germany.—Quoted rates for district of Stettin. (German industrial inspector's report and "Labor Overseas.")

Japan.—Average wages for all of Japan, 1913 and 1914; wages per day in Yokohama for 1919 and 1920. (Department of Agriculture and Commerce for Japan and Monthly Journal of Yokohama Chamber of Commerce.)

England.—Average rates for the principal cities in England as of August 4, 1913 and 1914, and December 1, 1920. (*British Labor Gazette,* August, 1913, and February, 1921.)

France.—Quoted rates for large cities in France. (*Revue du Travail* and *Commerce Report,* January, 1921.)

Spain.—Daily wages in Barcelona and Vigo. (*Monthly Labor Review,* February, 1921, and December, 1920.)

Austria.—Wages per day. (American Commissioner A. H. Frazier.)

—*A. G. C. Bulletin.*

WALNUT 2953 Evenings, WALNUT 1226
" " " 2968

BECKER & BECKER

DEALERS IN

NEW AND REBUILT MACHINERY

WE BUY, SELL, RENT AND REPAIR

5156 Grand River Ave. DETROIT

TANKS will never be cheaper

At our prices we should sell a tank every thirty minutes!

We sell all kinds and any kind of tanks, make lowest prices, and guarantee them.

New and used tanks in any part of the country.

Steel storage and pressure tanks
" and wood rectangular "
" " " water and oil "
" " " towers and "
" galvanized and special "
" jacketed and agitated "
" with heating coils, etc. "

Tanks for oil, gasoline, tar, molasses, coal, sand, feathers, acid, air, gas, etc., etc.

Anything BUT Concrete Tanks

THE CURTISS-WILLIS CO.
30 Church Street New York
LARGEST DEALERS IN TANKS

LOCOMOTIVE CRANES

1—25-ton Industrial Locomotive Crane, 8-wheels, standard gauge. MCB., double drum for handling clamshell bucket. Equipped with 50-ft. steel lattice boom. ASME boiler. Crane new in 1918. Excellent condition.

2—15-ton Brown Hoist Locomotive Cranes, 8-Wheel, MCB. double drum for handling clamshell bucket. Standard gauge. Equipped with 50' steel lattice booms. ASME boilers, Massachusetts Standard. Cranes new 1918. Perfect condition.

BYERS AUTO CRANE

1—No. 3 Byers Crane. Caterpillar traction. New August, 1920. Equipped with 30-ft. boom and ¾-yd. Owen clamshell bucket. Condition equivalent to new. Located Youngstown, Ohio.

STANDARD GAUGE LOCOMOTIVE

1—13 x 18 American, standard gauge Saddle Tank. Built new Dec., 1913. Type O-4-O. MCB and ICC. 165 lb. steam. Full extended tank. Westinghouse Air Pump and straight line air. Overhauled and equipped with set of new tires.

CABLEWAY DRAGLINES

1—10 x 12 Lidgerwood Cableway Dragline. Engine 10 x 12. Outfit complete with ASME boiler, 70-ft. tower, 1½-yd. dragline bucket. Cable for 600-ft. span. New 1918. Splendid condition.

1—1½-yd. Sauerman Dragline. 100-ft. steel tower, 900-ft. span, 100-H. P. motor. 60 cycle, 3 phase, 440 volts.

STEAM SHOVELS, DUMP CARS, DERRICKS.

B. M. WEISS
1324 Widener Bldg. Philadelphia, Pa.

FOR SALE

One No. 8-K GATES and No. 5-K GATES.

McCULLYS—No. 6, No. 7½ and New 13" Short Shaft.

LOCOMOTIVE CRANES, STEAM SHOVELS, CONSTRUCTION EQUIPMENT—NEW—USED—REBUILT.

FRANK T. CRAVEN COMPANY
50 CHURCH STREET NEW YORK
Telephone, 6341-7664 Cortlandt

BYERS CRANES

Full Circle, Standard "Auto Crane," Model "1" Auto Crane. Write for Bulletins.

THE BYERS MACHINE CO.
480 Sycamore St. Ravenna, Ohio

Agents in Leading Cities

BYERS AUTO-CRANE AND REVOLVING TYPES CRANES

BYERS *Model "7"*
Full Circle Crane

LYNCHBURG FOUNDRY COMPANY
LYNCHBURG, VA.

Manufacturers of

Cast Iron Water and Gas Pipe
Flanged Pipe and Flanged Fittings

QUICK—RELIABLE SERVICE

WARRENITE BITULITHIC
MEANS UP-TO-DATE
Road and Street Construction

Write for illustrated booklet

WARREN BROTHERS COMPANY
Executive Offices: Boston, Mass.

DISTRICT OFFICES:

New York, N. Y.	Utica, N. Y.	Toronto, Ont.
St. Louis, Mo.	Winnipeg, Man.	Phoenix, Ariz.
San Francisco, Cal.	Nashville, Tenn.	Vancouver, B. C.
Chicago, Ill.	Portland, Ore.	Minneapolis, Minn.
Richmond, Va.	Los Angeles, Cal.	

When writing to advertisers, please mention the Contractors' & Engineers' Monthly

Manufacturers' Representatives & Distributors of Contractors' Equipment

C. B. DAVIS ENGINEERING COMPANY

Brown Marx Bldg. Birmingham, Ala.

CRANES
HOISTS
CONVEYORS
BELTS
CRUSHING EQUIPMENT
DREDGES
PUMPS
BUCKETS

JOHN D. TURNER COMPANY
BIRMINGHAM, ALABAMA
CONTRACTORS' EQUIPMENT

Representing
Lakewood Engineering Co.,
Terry Mfg. Co.,
Easton Car & Construction Co.,
Barber-Greene Co.,
Stroudsburg Engine Works,
Barnes High Pressure Pumps,
Pittsburgh Wire Rope,
Bayley-Springfield Steel Sash,
Bostwick Steel Lath Co.,
Gillis & Geoghegan.

WHEN YOU WANT FIRST CLASS EQUIPMENT

Such As

Steel Rails, Locomotives, Cars, Steam Shovels, Dragline Machines, Locomotive Cranes, Rock or Ore Crushers, Pulverizers, Tractors, Dredges, Cableways, Wherlies, Derricks, Concrete Mixers, Asphalt Plants, Sand and Gravel Washers, Rotary Dryers, Dry Kilns, Hoist Engines, Turbor Generator Electric Sets, D. C. Sets, Motors, Fuel Oil Electric Sets, Log Loaders, Skidders, and Air Compressors.

Just Write, Wire or Phone

J. F. DONAHOO CO.
BIRMINGHAM, ALABAMA, U. S. A.

What You Want—We Have

Everything in
Metal Working Machinery—Cat. "M"
Wood Working Equipment—Cat. "W"
Contractors' Equipment—Cat. "C"
Engines, Motors, Pumps, Etc.—Cat. "P"
Supplies and Transmission—Cat. "S & G"

Send for Catalog and our Illustrated Priced Stock Bulletin.

SMITH-BOOTH-USHER CO.
LOS ANGELES 228-238 Central Ave. SAN FRANCISCO 50-60 Fremont St.

SOUTHERN STATES MACHINERY CO.
Woodward Building, Birmingham, Ala.
Mining and Contractors' Equipment

Representing
Koppel Industrial Car & Equipment Co.
Aurora Pump & Mfg. Co.
Williams Clam Shell Buckets
Plymouth Gasoline Locomotives
Keystone Well Drills
Foote Multi-Foote Pavers
Thew Automatic Shovels
O. & S. Locomotive Cranes
Compressors

E. W. BENTLEY, M. E.
MACHINERY
Concrete Equipment, Boilers, Hoists, Cranes, Pumps

214 Duval Bldg. Jacksonville, Fla.

Representing:
RANSOME CONCRETE MACHINERY CO.
McMYLER INTERSTATE CO.
ORR & SEMBOWER
LEBANON BOILER WORKS
METAL FORMS CORPORATION
KEWANEE PRIVATE UTILITIES CO.

THE CAMERON & BARKLEY COMPANY

General Contracting Supplies
Tampa, Fla.

Distributors of
Concrete Mixers, portable woodworking machinery, Blaw-Knox Forms, pumps, engines, hoisting engines, wheelbarrows, road building equipment, reinforcing bars, water systems, manila and wire rope blocks, wire and manila rope.
CAREY ROOFING PRODUCTS
TAMPA, JACKSONVILLE, MIAMI, FLA.
CHARLESTON, S. C.

CONSTRUCTION AND MATERIAL HANDLING . . . EQUIPMENT . . .

Equipment Corporation of America
CHICAGO, ILL.
1409 Lumber Exchange Building
Phone, Randolph 6586

EDGAR ALEXANDER
905 Fourth National Bank Bldg. Atlanta, Ga.
REPRESENTING
Koehring Company, Milwaukee, Wis., Concrete Pavers, Mixers, Locomotive Cranes, Bar Cutters, Bar Benders, etc.
J. S. Mundy Hoisting Engine Co., Newark, N J., Hoists, Derricks, Contractors' Equipment, etc.
Automatic Signal & Sign Co., Canton, Ohio, "Redflex Signals".
Barnes Mfg. Company, Mansfield, Ohio., Barnes Pumps.
Construction Machinery Co., Waterloo, Iowa, Wonder Mixers, Hoists, Pumps, Backfillers, etc.
Evinrude Motor Company, Milwaukee, Wis., Evinrude Centrifugal Pumps.
Universal Road Machinery Company, Kingston, N. Y., Reliance Crushers, Street Sweepers, Oilers, Car Unloaders, etc.
Burch Plow Works, Crestline, Ohio, Stone Spreaders, etc.
Also other lines including Steel Forms, Hoist Tower equipment, etc.

FISCHER & HAYES ROPE AND STEEL CO.
741-745 W. Van Buren St.
CHICAGO, ILL.
LESSORS OF:
Little Wonder Suspended Scaffolds
Wire Rope, Manila, Blocks
General Contractors' Supplies

W. E. AUSTIN MACHINERY CO.
Contractors' Equipment
2 Spring Street Atlanta, Ga.
"The Ausco Line"
Concrete Mixers and Pavers. Concrete Chuting Plants. Gas and Steam Hoists. Steam Pile Hammers. Revolving Cranes. Dragline Excavators. Steam Shovels. Road Forms. Car Unloaders. Crushing Plants and Quarry Equipment. Air Compersors and Pumps. Gas Locomotives. Industrial Tracks.

R. H. HYLAND CO.
Wells Street Bridge,
Chicago, Ill.
REPRESENTING: Oshkosh Mfg. Co., McKiernan-Terry Pile Hammers, Insley Mfg. Co., Williams Clam Shell Buckets, Norton Ball Bearing Jacks, Wyoming Red Edge Shovels
EQUIPMENT and SUPPLIES

YANCEY BROTHERS
550-556 Whitehall St. Atlanta Ga.
Representing
Holt "Caterpillar" Tractor.
J. D. Adams & Co., Adams Leaning Wheel Graders.
American Scraper Co., Wheeled Scrapers—Drag Scrapers.
Miami Trailer Co., Miami Trailers.
Wyoming Shovel Works.
Union Iron Products Co., Metal Road Signs.
Acme Road Machinery Co.,
The Jaeger Machine Co., Concrete Mixers.
Baker Manufacturing Co., Wheel-Scrapers.
Stroud & Co., Elevating Graders.

GEO. G. TUCKER CO.
53 W. Jackson Blvd. Chicago
Telephone Harrison 5057
STEAM SHOVELS
BARNES HIGH PRESSURE PUMPS
ROAD BUILDERS' EQUIPMENT

THOMAS L. BARRET
Contractors' Equipment
LOUISVILLE, KY.

"Rex" Mixers and Pavers
Corrugated Bars
Triangle Mesh
"Pioneer" Expansion Joint
"Kreolite" Wood Block
"Monarch" Road Rollers
"Champion" Steel Plate Crushers
"Winner" Graders
"Hvass" Sweepers and Spreaders
"Champion" Oil Distributors

OLE K. OLSEN
822 PERDIDO ST., NEW ORLEANS, LA.

ALWAYS IN STOCK

CONCRETE MIXERS AND CHUTES, HOISTING ENGINES, DERRICKS, EXCAVATING BUCKETS, SAW TABLES, GASOLINE ENGINES, DIAPHRAGM PUMPS, STEAM PILE HAMMERS, ROAD MACHINERY, ETC.

BRANDEIS MACHINERY & SUPPLY CO.
325 W. Main Street, Louisville, Ky.

Representing:
T. L. Smith Co.,
Smith Engineering Works
Insley Manufacturing Co.
Blaw-Knox Company
Lidgerwood Mfg. Co.
Sterling Wheelbarrow Company
Wyoming Shovel Works
Domestic Pump and Engine Co.

GILES & RANSOME
1008 Commonwealth Bldg, Philadelphia, Pa.
406 Builders Exchange, Baltimore, Md.
Representing:
Ransome Concrete Machinery Co.—Concrete Mixer and Appliances.
Orr & Sembower, Inc.—Engines, Boilers, Hoists, etc.
Blaw-Knox Company—Clam-shell Buckets, Steel Forms, Steel Buildings.
Richmond Screw Anchor Company—Concrete Specialties.
Evinrude Motor Company—Evinrude Centrifugal Pumps.

We can ship from stock
LOUISVILLE, KY.
Contractors' equipment of all kinds
Concrete Mixers
Hoists (Steam, elec. and gasoline)
Cranes and Clam Shell Buckets
Portable Gasoline Compressors
Tripod and Hammer Drills
Holt "Caterpillar" Tractors
Baker Maney 4-Wheel Scrapers
Road Graders, etc.
ROY C. WHAYNE SUPPLY CO.

W. H. ANDERSON TOOL & SUPPLY CO.
Brush & Macomb Sts. Detroit, Mich.
GRAND RAPIDS BRANCH
303 Bridge St., N. W.
Michigan's Oldest and Largest Dealers in Contractors' Equipment.
Steam Shovels,
Concrete Mixers,
Hoisting Engines, and Derricks,
Pumping apparatus of all kinds,
Concrete Towers and Spouting,
Wheel Scrapers, and Road Building Equipment.
Everything in Small Tools.

"Menge Pumps for Low Heads"
MENGE PUMP & MACHINERY CO., Ltd.
862 Tchoupitoulas St., New Orleans, La.
REPRESENTING—
Novo Engine Company—Engines, Gas, Gasoline, Kerosene—Air Compressor Outfits—Pumping Outfits—Hoisting Outfits—Sawing Outfits.
Kinney Mfg. Co.—Heavy Fluid Pumps.
American Well Works—Centrifugal and Deep Well Pumps.
Foos Gas Engine Co.—Gas, Gasoline and Distillate Engines.
Hoppes Mfg. Co.—Feed Water Heaters, Purifiers—Steam Separators—Oil Eliminators—Exhaust Heads.
Monarch Tractors Inc.—"Industrial" Tractors.
Hicks-Parrett Tractor Co.—Round Wheel Tractors

J. W. DOPP & CO.
34 West Columbia St., Detroit, Mich.
REPRESENTING
Sterling Wheelbarrow Co.
T. L. Smith Co.
Smith Engineering Works
Insley Manufacturing Co.
Mead - Morrison Mfg. Co.
Wyoming Shovel Works
The Osgood Co.
Smith & Sons Mfg. Co.

Good Roads Supply Company
Material and Machinery for Roads and Streets
1409 Ford Building, Detroit, Michigan
Koehring Machine Co.
J. D. Adams & Co.
Blaw-Knox Co.
Acme Road Machinery Co.
C. H. & E. Mfg. Co.
Kilbourne & Jacobs Mfg. Co.
Automatic Sign & Signal Co.

Raymer Equipment Co.
56-58-60 E. 5th St., ST. PAUL, MINN.
Mixers Hoists Compressors
Pumps Engines Shovels
Belt conveyors and supplies.
Concrete Chutes Tower Equipment
Pile Hammers Wheelbarrows
Concrete Carts Crushers
Form Clamps Derricks.

FRANK G. KUHN
Construction Machinery, Contractors' Equipment
705 Detroit Savings Bank Bldg.
DETROIT, MICH.
Representing
Little Giant Road Cranes
Keystone Steam Shovels
Knickerbocker Concrete Mixers
Mortar Mixers and Saw Rigs
National Hoisting Engine Co.

"Brooks for Concrete Equipment"
R. E. BROOKS CO.
50 Church St. New York City
Representing
KOEHRING MACHINE CO.
INSLEY MFG. CO.
C. H. & E. MFG. CO.
HELTZEL STEEL FORM CO.
MUNDY HOISTING ENGINE CO.
STERLING WHEELBARROW CO.
WYOMING SHOVEL CO.
METAL FORM CO.

WALLACE EQUIPMENT COMPANY
400 Penobscot Building, Detroit, Mich.
Representative for State of Michigan
Clyde Iron Works, The Fate-Root-Heath Co.,
Symons Clamp Co., Patent Scaffolding Co.,
Roos Adjustable Shore Co., Sasgen Derrick Co
The Heltzel Steel Form & Iron Co.

BROWN & SITES CO.
Specialists in Contractors' Equipment
Main Office: 30 Church Street
New York City

WM. H. ZIEGLER CO., Inc.
Contractors' Equipment
Minneapolis, Minn. Duluth, Minn.
SALES AGENTS FOR
Rex Mixers and Pavers
Insley Towers and Chuting
Novo Engines and Outfits
Plymouth Gasoline Locomotives
P. & H. Excavators and Cranes
Williams Clamshell Buckets
Sterling Wheelbarrows and Carts
Wyoming Red Edge Shovels
Best Tracklayer Tractors
Stroud Wagons and Graders

OUR 1922 PRICES
are now available. We specialize in
LOCOMOTIVES LOCOMOTIVE CRANES
DUMP CARS ROAD BUILDING
STEAM SHOVELS EQUIPMENT
DAVIS EQUIPMENT CO.
50 CHURCH ST. NEW YORK

DEWEY
SUPPLY CORPORATION
Road Building Equipment
Bucket Loaders and Belt Conveyors
Mixers—Hoists—Compressors—
Pumps—Shovels and Spades
Small Tools and Heavy Hardware
Prices you CAN'T BEAT!
18 West 34th St. New York City
Phone Pennsylvania 1662

"Let George do it"
mixers, pumps, compressors, gasoline engines, derricks, hoists, road builders and excavation machinery.
E. GEORGE & CO., Inc.
407 Broadway New York City

EDWARD EHRBAR, Inc.
Contractors' Machinery Supplies
270 WEST STREET, NEW YORK, N. Y.
Representing
Conneaut Shovel Co.
Sidney Steel Scraper Co.
American Cement Machine Co.
Ideal Power Lawn Mower Co.

REPUBLIC MIXERS
Strength—MAXIMUM—Output
Price Minimum
Hoists, Derricks, Boilers, Compressors, Cranes & General Contractors' Equipment.
HOISTING ENGINE SALES CO.
1636 GRAND CENTRAL STATION
NEW YORK CITY

Frank W. S. Elmes
30 CHURCH STREET,
New York City
Representing:
BYERS LOCOMOTIVE CRANES
BYERS AUTO-CRANES
BYERS HOISTS

Browning Locomotive Cranes
EASTERN AGENT
J. C. HOUSTON
30 Church Street
NEW YORK CITY

FORSYTHE BROS.
30 Church Street, New York City
EASTERN AGENTS
for
Buffalo Hoist & Derrick Co.
MANUFACTURERS OF
Locomotive Cranes—Derricks
Hoisting Engines
Clamshell Buckets

The Hubbard-Floyd Co., Inc.
1112 GRAND CENTRAL PALACE
NEW YORK
REPRESENTING
KNICKERBOCKER CO.
Concrete Mixers
Portable Saw Rigs
Combination Woodworkers
IDEAL ENGINE CO.
Gasoline Engines
Diaphragm and Pressure Pumps
Single and Double Drum Hoists
Chattanooga Road Mach'y Co.
BUTT-JOINT NESTABLE CULVERT

Telephone Cortlandt 5326, 5327

S. B. WHINERY, M. E.

Exporter & Manufacturers' Agent

95 Liberty Street New York

Representing:

American Well Works—Pumps—Centrifugal, Deep Well, Steam and Power, Steam Turbines, Well Drilling Machines, Condensers.

Western Electric Company—Motors, Generators, Etc.

Columbus Steam Pump Works—Pumps, Simplex and Duplex, Steam and Power.

We Can Supply Anything In

Contractors' Equipment and Machinery

Get Our Prices—Wire—Phone—Write

THE T. J. LANE EQUIPMENT CO.

SPRINGFIELD, OHIO

BREWSTER & WILLIAMS, Inc.

613 Dillaye Bldg. Syracuse, N. Y.

Contractors' Supplies and Equipment

"REX" Mixers and Pavers
Austin-Western Road Machinery
Blaw-Knox Steel Forms, Storehouses and Buckets
Allan Electric Welders
American Steel & Wire Co.'s Mesh Reinforcement
Carey Expansion Joint
Corrugated Bars
"KWIK-MIX" Tilting Drum Mixers
Evinrude Centrifugal Pumps

MILLS CONTRACTORS' EQUIPMENT CO.

Chattanooga, Tenn.

Representing

Conneaut Shovel Co.	Shovels and Scoops
Toledo Wheelbarrow Co.	Bull Frog Wheelbarrows
Western Wheeled Scraper Co.	Scrapers, Plows, etc.
Fate-Root-Heath Co.	Plymouth Gasoline Locomotives
G. H. Williams Co.	Clam Shell Buckets
Erie Pump & Engine Co.	Centrifugal Pumps
International Crusher Co.	Crushing Machinery
Electric Welding Co.	Bar Benders, Rod Cutters, etc.
Chain Belt Co.	Chain and Sprockets
Simplicity Equipment Co.	Steam Pumping Outfits, Concrete Mixers

We carry in stock for quick shipment a complete line of small tools.

We specialize in Concrete reinforcing steel, new and relaying rails.

BAR BENDERS

BAR CUTTERS
COIL BENDERS
STIRRUP FORMERS

HAND OR POWER DRIVEN

THE McKENNA CO.

E. 38th and Perkins Ave., Cleveland, O.

ROBT. R. NIXON CO.

Chattanooga, Tennessee

CONTRACTORS' EQUIPMENT

American Hoist and Derricks
Blaw-Knox Buckets and Forms
C. H. & E. Saw Rigs, Pumps and Hoists
Cameron Pumps
Ingersoll-Rand Compressors
Lee Bodies, Trailers and Loaders
Rex Mixers and Pavers
Also Wheelbarrows — Carts — Benders— Cutters—Shovels—etc.

"He Profits Most Who Serves Best."

SYKES COMPANY

32 East Main Street

COLUMBUS, OHIO

Distributors:—

Holt Caterpillar Tractors
Miami Trailers
P. & H. Excavating Machinery
Wood Hoists and Bodies
Roytrac Wheel Scrapers
Royal and New Highway Graders
Barnes Pumps

C. TURNER COMPANY

922 James Building
Chattanooga, Tennessee

Machinery & Contractors Equipment

Representing

LAKEWOOD ENGINEERING CO.
CLYDE IRON WORKS SALES CO.
DOMESTIC PUMP & ENGINE WORKS
STORMS MANUFACTURING CO., Culvert Forms.
BATES VALVE BAG COMPANY, Bar Ties

LEWTER F. HOBBS, Inc.

NORFOLK, VA.

Contractors' Equipment and Machinery. Sixteen years in the business.

Our Customers Are Our References

BRITISH COLUMBIA, CANADA

Equipment for
Contractors, Loggers, Municipalities, Mines, Railroads and Industrial Plants

Supplied by

BROWN, FRASER & CO., Ltd.
VANCOUVER, B. C.

Kelly-Springfield

Caterpillar Tires

Kelly-Springfield Tire Co. **New York, N. Y.**

GRAVES MACHINERY COMPANY
Healey Bldg., Atlanta, Ga.

Sales Agents:
Thew Shovel Company, Steam, Electric and Gas Traction and continuous tread shovels.
Kilborne & Jacobs Mfg. Co., All steel Air Dump Cars and Contractors' Equipment.

Boilers, Engines, Road Rollers, Pumps, Electrical Equipment, Etc.

CONCRETE CONSTRUCTION HANDBOOK

96 pages, illustrated, and special Service Sheets or Bulletins on 50 Special Subjects, free to inquirers living east of the Mississippi.

Alpha Portland Cement Co.
General Offices: **EASTON, PA.**
Branch Offices: New York, Boston, Phila., Baltimore, Savannah.
Plants: Martins Creek, Pa., Cementon, N. Y., Jamesville, N. Y., Manheim, W. Va.

White Trucks

do the most work for the least money

THE WHITE COMPANY
CLEVELAND

PERFORMANCE COUNTS

Mack TRUCKS

The record of MACK equipment in all classes of municipal work is yours for the asking.

Motorize your equipment and save labor.

INTERNATIONAL MOTOR CO.
Public Works Department
NEW YORK

Tarvia
Preserves Roads Prevents Dust

THE Tarvia Service Department offers a mighty helpful service to road engineers, contractors and city authorities. It is manned by highway engineers of long experience, and provided with special apparatus of various kinds for handling Tarvia to the best possible advantage.

In many sections of the country we can provide automobile-tank service that brings the Tarvia hot from the works or from the tank-cars and delivers it on the job promptly and economically.

If you want real co-operation and service in your road work, call on the Tarvia Department of our nearest office.

The Barrett Company

New York, Boston, Cincinnati, New Orleans, Minneapolis, Chicago, St. Louis, Pittsburgh, Dallas, Philadelphia, Cleveland, Detroit, Kansas City, Salt Lake City

Road-Building by Tractor Quicker and Cheaper

IN breaking new roads, in grading, scarifying, plowing, excavating, leveling, and in heavy hauling, the Best Tracklayer Sixty does the work better and faster than horses and does it at less cost.

Its tremendous drawbar pull enables the Best to maintain an even cut with the grader. The power is unfaltering. There are no animals to favor on tough soil. No expert drivers needed to keep horses pulling together. The Best furnishes compact, dependable, easily-managed, flexible power, taking the place of 30 horses or mules and operating at a much lower cost. Besides, the Best will do a great deal of work which horses cannot perform.

Another advantage in favor of the Best Sixty for road work is its ability to negotiate ground too soft for animals and too rough for trucks. The long, wide tracks distribute the weight over so great an area that the ground pressure per square inch is less than that of the average-sized man. The tracks also bridge ruts and holes and gaps, enabling the Best to work efficiently under very unfavorable ground conditions.

There are many mechanical features of the Best that are responsible for Best performance. This tractor is the result of a development covering many years of tractor-building experience. Design, choice of materials, engine, workmanship—all have been time-tested and proven in actual practice. For years the Best has been conspicuously successful on the big heavy-duty work of the West.

Our catalog fully explains these mechanical features and their time-tested advantages. Write for it. Also ask for the name of our nearest dealer.

C. L. BEST TRACTOR CO.
SAN LEANDRO CALIFORNIA

NORDBERG MACHINERY

We make a complete line of

STEAM ENGINES
OIL ENGINES
MINE HOISTS
AIR COMPRESSORS
BLOWING ENGINES
CONDENSERS

Our experienced engineers will gladly consult with you

Nordberg Manufacturing Co.
Milwaukee, Wisc.

A PITOMETER SURVEY :: ::

Will positively unearth all sources of water waste including underground leaks which cannot be seen on the surface. Let us prove it to you by demonstration in a "Test District."

Send us your address for further information.

The Pitometer Co.
Hudson Terminal Bldg., New York

VALUABLE INFORMATION YOU SHOULD HAVE !

FREE ON REQUEST.

PUT YOUR PUMPING PROBLEMS UP TO PUMPING EXPERTS
Indiana "ECONOMY"
AIR LIFT SYSTEMS FOR WELLS, Air Lift Separator-Pumps, Air Compressors, Air Receivers, Electric Motors, Centrifugal Pumps, Reciprocating Pumps, Deep Well Pumps, Impeller Pumps, Gasoline and Oil Engines, Indiana Engineering Service.
ASK FOR OUR
"Booklet on Deep Well Pumping"
INDIANA AIR PUMP COMPANY
INDIANAPOLIS, INDIANA

LOCK BAR STEEL PIPE

MAXIMUM { STRENGTH
CARRYINC CAPACITY
DURABILITY

SIZES 20" TO 72" DIA.

EAST JERSEY PIPE COMPANY
7 Dey Street New York City

EVERYTHING FOR THE WATERWORKS

Tapping Machines, Hydrants, Valves, Gate Valves, Fire Hydrants, Water Works Specialties. Write for booklet.

A. P. SMITH MFG. COMPANY
EAST ORANGE, NEW JERSEY

Clean Your Sewers with the
TURBINE MACHINE

It makes no difference what may clog your sewers, this machine will do the work and do it satisfactorily.

Send for our latest catalog.

Turbine Sewer Machine Company
195 Eleventh Street
MILWAUKEE :: WISC.

Illustrated book—free

The eye-opening story of wood pipe—its life, uses and economy—is interestingly told in the finest pipe book ever printed. The data file of NO engineer or Contractor who in any way recommends, or influences decisions for pipe, is complete without a copy. Request yours today. * * * WESTERN WOOD PIPE PUBLICITY BUREAU, White Bldg., Seattle, Wash.—Monadnock Bldg., San Francisco, Calif.

Redwood *Douglas Fir*

WOOD PIPE

CONTINUOUS STAVE-WIRE WOUND-BORED

DU PONT

Concentrated Filter

ALUM

OUR 22% Al_2O_3, containing 73% aluminum sulphate, is the highest strength alum on the market today and for this reason the most economical.

It is especially adapted for use where low alkalinity and high turbidity make filtering problems difficult.

It removes all vegetable matter and diminishes the amount of bacteria in the water.

We also manufacture 17% alum which can be used in any type of mechanical filter plant.

E. I. du Pont de Nemours & Co., Inc.
Sales Dept.: Acids & Heavy Chemicals Division
WILMINGTON, DELAWARE

Branch Offices:

NEWARK
240 Vanderpool Street
Telephone, Waverly 4670

PHILADELPHIA
3500 Grays Ferry Road
Telephone, Dickinson 50

Iron Horse Metalware for Contractors'

Galvanized Cans
Pails
Rubbish Cans
Garbage Cans
Engineers' Cans
Oily Waste Cans
Ash Cans
Corrugated Baskets

SEND FOR OUR CATALOGUE

ROCHESTER CAN CO.
109 Hague St. Rochester, N. Y.

CRANE

VALVES — FITTINGS
STEAM SPECIALTIES

are made in all sizes for all pressures and air purposes.

CRANE CO.
836 S. MICHIGAN AVE. CHICAGO

MECHANICAL RAPID SAND FILTRATION PLANTS
FOR
WATER WORK SYSTEMS
ALSO
"HOLYOKE" FIRE HYDRANTS
"STREETERS" REMOVABLE PLUGS
NORWOOD ENGINEERING CO.
Florence, Mass.

HAZARD

Rubber Insulated
WIRES & CABLES
"Made for users who want the Best"
Hazard Manufacturing Company
Wilkes-Barre, Penna.
New York Pittsburgh Chicago Denver

And They Are Still Buying "Americans"—

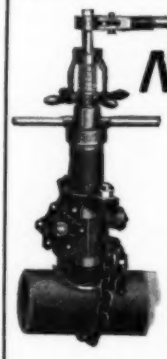
Back in 1915, the City of Hastings, Nebraska, after having carefully investigated deep well turbines—purchased an "American" Deep Well Turbine.

In 1919, a greater supply of water was necessary—and they purchased another "American" Deep Well Turbine!

Again in 1920, when more pumps were needed—they purchased an "American" Deep Well Turbine!!

It has taken nearly half a century of experience and design to develop pumping machinery that gives the sort of service that inspires repeat orders—"American" service is **consistently good.**

The American Well Works
General Offices and Works, Aurora, Ill.



MUELLER

WATER MAIN TAPPING MACHINES

and all kinds of Water Works, Gas Works and Plumbing Brass Goods.

Strictly High Grade Products which give the utmost in service at the smallest upkeep expense.

Fully Warranted

H. MUELLER MFG. CO.
DECATUR, ILL.
New York San Francisco

APPROVAL

HERSEY DETECTOR METER

The Hersey Detector Meter has been accepted for thirteen years in 3, 4, 6, 8, 10 and 12 sizes without any restrictions or conditions of any kind by every Insurance Company Stock and Mutual, doing business in the United States, and by the Water Departments and Water Companies in more than 600 Cities and Towns for use on over 4,000 Fire Services protecting over $2,000,000,000 worth of Insured Property

HERSEY MANUFACTURING COMPANY

BOSTON NEW YORK CHICAGO COLUMBUS, O
PHILADELPHIA ATLANTA SAN FRANCISCO

Union Water Meter produced to meet the demands of all water department service.

Write for printed matter

Union Water Meter Co.
Worcester, Mass.

LAMBERT
WATER METERS

Made in all sizes, 5/8" to 6", of best Bronze Composition Thruout, fitted with unbreakable reinforced disc-pistons.

Write for booklet

THOMSON METER CO.
100-110 Bridge Street
Brooklyn, N. Y.

CHEMICALS
for Water Purification
We manufacture the highest grades of
SULPHATE of ALUMINA
also
CHLORIDE of LIME
and
LIQUID CHLORINE
PENNSYLVANIA SALT Mfg. Co.
WIDENER BLDG. PHILADELPHIA, PA.

Does Your Stock of Pipe-Fittings Include
Ford "RAMS-HORN" Meter Frames?

There's a reason why so many meter men swear by "Rams-horns"! They are so down-right handy when it comes to installing, replacing or removing meters that ordinary fittings are out of date!!

Just drop us a card, please

Ford Meter Box Company
Everything But The Meter
Wabash, Indiana

Also Manufacturers of Meter Boxes, Meter Testing Machines, Adjustable Pipe Couplings

METERS

FOR OIL, GASOLINE WATER, ETC.

25 YRS. ON THE MARKET
400,000 SOLD

BUFFALO METER CO.
2898 Main St. Buffalo, N. Y.

WATER METERS OF THE HIGHEST QUALITY ONLY

Every measuring requirement of any water dispensing service can be successfully met by our six different types. CROWN (Rotary piston); NASH (Disc); GEM (Velocity); EMPIRE (Oscillating piston); EMPIRE-COMPOUND (Combining GEM & EMPIRE) and PREMIER (Venturi).

National Meter Company
299 BROADWAY NEW YORK
Send for fully illustrated catalogue

SIMPLEX WIRES AND CABLES
— FOR —
STREETS AND PARKWAYS

Steel Taped Cables
For underground service without conduits. Easy to handle and inexpensive to install. It is flexible.

"Fibrex" Tree Wire
For overhead service among trees. Covered with a non-metallic, non-inductive armor that resists abrasion.

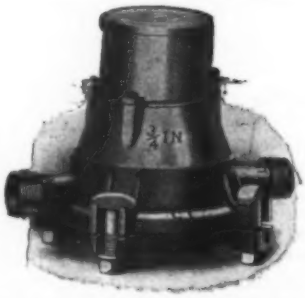
SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

VENTURI METERS

are recognized as standard equipment for gravity mains, filtration plants, pump discharge lines, sewage disposal systems, hydraulic turbines, etc., by the most prominent municipalities.

Builders Iron Foundry
"Builders of the Venturi for 29 years"
Providence, R. I.

Type M Register



Badger Water Meters Help to Stop Waste

Badger Water Meters guard the water supply against wilful waste, also make an appreciable cut in your coal bill.

Send us your address for information on how water meters can reduce overhead expenses.

BADGER METER MFG. COMPANY
841-847 30th Street Milwaukee, Wis.

PITTSBURGH METER COMPANY

Water Meters For All Domestic and Industrial Services

Manufacturers of
Arctic Keystone
Eureka
and
Keystone-Compound

East Pittsburgh, Pa.
New York Kansas City
Chicago Los Angeles
Seattle
Columbia, S. C.

ELECTRICAL PRODUCTS

To develop machinery for the generation, transmission, distribution and utilization of electricity in the form of light, heat and power, has been the aim of the General Electric Company for more than a quarter century.

G-E engineers in sales offices in all large cities are ready to assist in any problem where electricity may be used.

General Electric

General Office Schenectady, N.Y. Company Sales Offices in all large cities

King Street Lighting Standards

Write for illustrated matter

MADE BY

KING MANUFACTURING COMPANY

53 W. Jackson Boulevard

CHICAGO, ILL.

UNION METAL LAMP STANDARDS

Union Metal and General Electric engineers will point out for you the "Right way for your White Way," whether your requirements be a large spectacular business district standard or a small, modest type for parkway or private grounds.

Send for complete catalog

The Union Metal Manufacturing Co.
CANTON OHIO

UNION METAL LAMP STANDARDS

ELRECO COMBINATION RAILWAY and LIGHTING POLES

Make Lamp Standards unnecessary, one pole at half the cost does double duty—supports the trolley span wires, also ornamental bracket and handsome Lighting Fixture.

Full details in Catalog F—sent on request.

Electric Railway Equipment Co.
Cincinnati, Ohio
New York Office, 30 Church St.

DIRECTORY of ENGINEERS, CONTRACTORS, ARCHITECTS, ETC.

INTELLIGENT PLANNING — PROPER CONSTRUCTION

E. T. ARCHER & CO.
Consulting Engineers
Steam & Hydraulic Power Plants, Water, Sewerage, Paving, Roads, Appraisals, Testimony, Reports,
609-10-11-12 New England Bldg., Kansas City, Missouri.

New York City 2 Rector Street
A. E. HANSEN
Hydraulic & Sanitary Engineer
Design & Supervision of Construction
Sewerage — Water Works
Sewage Disposal — Water Purification
Drainage — Water Works Valuation
Garbage Disposal — Water Analyses

PEASE LABORATORIES, Inc.
Successors to
LEDERLE LABORATORIES
Sanitary, Bacteriological and Chemical Investigations for the Community or Individual.
39 W. 38th St., N. Y. City.

BANKS & CRAIG
51 East 42nd St., New York City
709 Telegraph Building Harrisburg, Pa.
Municipal, hydraulic and sanitary engineers.
Design, operation, valuation.

J. WALLACE HIGGINS
Assoc. M. Am. Soc. C. E.
Civil and Landscape Engineer
Municipal Engineering, Sewerage, Parks, Cemeteries, Subdivisions, Topographic Surveys, Title Surveys, Estimates, Supervision.
82 Vanderbilt Avenue, NEW YORK

CLARENCE D. POLLOCK
Member Am. Soc. C. E.
Consulting Engineer,
Pavements, Highways, Drainage, Sewerage, Town Planning and General Municipal Problems.
Reports, Specifications, Supervision.
Park Row Building, New York City.

Fuller & McClintock
CONSULTING HYDRAULIC ENGINEERS and SANITARY EXPERTS
170 Broadway, New York City
George W. Fuller James R. McClintock Jesse K. Gidney

Nicholas S. Hill, Jr. S. F. Ferguson
HILL & FERGUSON
Consulting Engineers
WATER SUPPLY—SEWAGE DISPOSAL—HYDRAULIC DEVELOPMENTS.
Reports, Investigations, Valuations, Rates, Design, Construction, Operation, Management. Chemical and Biological Laboratories
112 E. 19th St., New York City

Clyde Potts
30 CHURCH ST. NEW YORK
Civil and Sanitary Engineer
Sewerage and Sewage Disposal Works, Hydraulics, Water Works, Filtration, Reports, Plans and Estimates.

FREDERICK GLAESER
CIVIL ENGINEER
Assoc. Member A. S. C. E.
Surveys — Inspection — Reports—Quantity Surveys—Contractors' Estimates—Materials listed from plans.
Bids Prepared Rates Moderate
Contracts for Line & Grade Work.
660 Rutherford Ave., Trenton, N. J.

KELKER, GATES & DE LEUW
CONSULTING ENGINEERS
111 W. Wash'ton St. 325 Pekin St.
CHICAGO, ILL. LINCOLN, ILL.
STREET RAILWAYS
Franchises — Rates — Service — Valuations.
MUNICIPAL WORKS
Pavements — Sewerage — Water Supply.

C. B. RICHARDS
ACCOUNTANT AND AUDITOR
280 Broadway, New York City
Systems Installed—Statements Prepared—Books and Accounts disentangled.
All classes of engagements, large and small, handled. Let me hear from you.

GULICK-HENDERSON CO.
Inspecting Engineers and Chemists
145 West 30th St., New York, N. Y.
INSPECTION AND TESTS OF
Structural Steel — Road Material
Cement — Creosoted Wood Blocks
Pipe — Railway Equipment
Pittsburgh—Chicago—Philadelphia

McClure Greene Engineering Co.
Civil and Consulting Engineers
Water Works, Sewers, Sewage Disposal, Streets, Pavements, Bridges, Dams, Concrete Structures, Hydraulic Developments. Investigations, Surveys, Designs, Specifications, Estimates, Reports, Construction Supervision and Management.
612-613 Park Building, Worcester, Mass.

Robinson, Geo. L.,
Consulting Engineer.
Sewers, Sewage Disposal, Water Supply.
New York 37-39 East 28th Street

FREDERICK SNARE CORP. Formerly THE SNARE AND TRIEST CO.
CONTRACTING ENGINEERS
8 West 40th Street, New York
Harbor Works, Railroads, Bridges, Industrial Plants, Sugar Plants, Steel and Masonry Construction, Tanks, Pipe Lines, Water Works.
Cable Address, Santee, New York. Western Union and Lieber Codes Used.
Cable Address, Pawnee, Havana. Havana Office, Zulueta 36 D.

EDWARD F. TERRY, Chairman of the Board — GEORGE O. WAGNER, Vice-Pres. & Treas.
FREDERICK TENCH, President — HOWARD H. SHERWIN, Vice-Pres. & Gen. Manager
THE TERRY & TENCH CO., Inc.
ENGINEERS and CONTRACTORS
GRAND CENTRAL TERMINAL NEW YORK CITY

C. E. SMITH & CO., Consulting Engineers
2065-75 Railway Exch. Bldg., St. Louis
1313 Steger Bldg., Chicago
204 Live Stock Exchange, Kansas City
Investigation, reports, appraisals, expert testimony, bridge and structural work, railway problems, electrification, grade crossing elimination, foundations, highways, docks, water supply, river and flood protection, drainage and sanitation, power plants.

Exterior Painting
G. URDI CO.
Bridge and Structural Iron
COLDEN AVENUE AND BOSTON ROAD, NEW YORK
Established 1904

Gilbert C. White, C. E.
M. Am. Soc. C. E.
M. Am. Soc. M.E.
CONSULTING ENGINEER
Durham, N. C.
An organization of Civil, Mechanical, Electrical and Chemical Engineers. Waterworks, Streets, Power Plants.

W. R. Conard — J. S. Busby
CONARD & BUZBY
BURLINGTON, N. J.
Specialists on Water Works—
Materials, Specifications, Inspections, Reports, Designs, Tests

CONSULTING ENGINEERS
CIVIL
ELECTRICAL
MECHANICAL
GEORGE A. JOHNSON COMPANY
INCORPORATED
150 Nassau St., New York, N. Y.
Water Supply and Purification, Sewerage, Refuse Disposal, Power Development and Distribution, Industrial Plants and Public Utilities.
REPORTS, DESIGNS
VALUATIONS,
SUPERVISION OF
CONSTRUCTION
MANAGEMENT

OVER HALF A CENTURY IN CHICAGO
THE EDGAR A. ROSSITER CO.
CONSULTING ENGINEERS
127 N. Dearborn St., Chicago
Water supply, sewerage, and sewage disposal, drainage, farm and levee-pumping plants, electric light systems, pavements, track elevation, tunnels, mining.

UNIVERSAL AUDIT COMPANY
ACCOUNTANTS AND AUDITORS—INDUSTRIAL ENGINEERS
SINGER BUILDING (Cortlandt 6857) NEW YORK
SPECIALISTS IN ORGANIZATION AND MANAGEMENT PROBLEMS
PRODUCTION, COSTS, INDUSTRIAL RELATIONS

AMERICAN CHIMNEY CORPORATION of New York
Designers and Builders Radial Brick Chimneys
May we send you our Catalogue?
Main Office: 147 Fourth Avenue, New York
BRANCHES: Chicago: 1101 Security Building. Cleveland: 919 American Trust Building. Philadelphia: Stephen Girard Building. Boston: 141 Milk Street.

Road Maintenance
Within 24 hours after the first distribution of Dow Calcium Chloride Flake you will be thankful you have found this inexpensive, easy way to eliminate dust and preserve gravel roads far beyond the ordinary term of road life.
It is an effective road binder and dust preventative that solves your road maintenance problems by holding the fine particles together. Information free.
One man drives the truck, another pours flakes into the hopper and watches distribution.
THE DOW CHEMICAL COMPANY
Midland, Mich., U. S. A.

NORTHERN ROTARY PUMPS
¶ Will deliver more gallons per minute per horsepower than any other pump.
¶ There are over three hundred Users of Northern Rotary Pumps who will testify to this fact.
¶ The Northern Rotary Pump can be furnished to fit any truck for fire service—on hand drawn trucks as electrically or gasoline driven units—as stationary units with electric or gasoline motors for fire or water works service.
Write for our new catalog today.
NORTHERN FIRE APPARATUS CO.
MINNEAPOLIS, MINNESOTA
Manufacturers of the Northern Trailer Pump for Fire Service

INDEX TO ADVERTISERS

After referring to the "Where to Purchase" Section, on pages 3 to 37, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

Acme Road Machy. Co..... 6
Alexander, Edgar..... 83
Allis-Chalmers Mfg. Co..... 89
Alpha Portland Cement Co..... 87
American Chimney Corp. of N.Y. 97
American Well Works..... 89
Anderson Tool & Sup. Co., W. H. 84
Archer & Co., R. T..... 96
Austin Machinery Co., W. E..... 83
Austin-Western Road Mach'y Co. 28
Autocar Co..... 40

Badger Meter Mfg. Co..... 94
Baker Mfg. Co..... 18
Banks & Craig..... 96
Barber Asphalt Paving Co..... 100
Barrett, Thos. L..... 84
Barrett Company, The..... 89
Bay City Dredge Works..... 10
Becker & Becker..... 81
Bentley, E. W..... 82
Best Tractor Co., C. L..... 88
Brandeis Machy. & Supply Co... 84
Brewster & Williams, Inc..... 87
Brooks Co., R. E..... 85
Brown, Fraser & Co..... 88
Brown & Sites Co..... 85
Bucyrus Co..... 30
Buffalo Meter Co..... 93
Buffalo-Springfield Roller Co.... 28
Builders Iron Foundry..... 94
Byers Machine Co..... 81

Cameron & Barkley Co., Inc.... 83
Carey Co., Philip..... 16
Central Foundry Co..... 1
Cleveland Tractor Co..... 32
Conard & Buzby..... 97
Connery & Co..... 12
Crane Co..... 92
Craven Co., Frank T..... 81
Cummings Machine Co..... 22
Curtiss-Willis Co., The..... 81

Davis Engineering Co., C. B.... 82
Davis Equipment Co..... 85
Delaware Clay Products Co..... 37
Denver Rock Drill Mfg. Co..... 12
Dewey Supply Co..... 86
Donahoo Co., J. F..... 82
Dopp & Co., J. W..... 84
Dow Chemical Co..... 97
Du Pont de Nemours & Co., E. I.. 91

East Jersey Pipe Co..... 90
Ehrbar, Inc., Edward..... 86
Electric Railway Equipment Co. 95
Elmes, Frank W. S..... 86
Engineering News-Record..... 2
Equipment Corp. of Am..... 83
Equitable Asphalt Maint. Co.... 6

Fairfield Engineering Co..... 12
Fischer & Hayes Rope & Steel Co. 83

Ford Meter Box Co..... 93
Forsythe Bros..... 86
Fuller & McClintock..... 96

General Electric Co..... 95
General Motors Truck Co..... 99
George & Co., Inc., E..... 86
Giles & Ransome..... 84
Glaeser, Frederick..... 96
Good Roads Machinery Co..... 24
Good Roads Supply Co..... 85
Graves Machinery Co..... 88
Gulick-Henderson Co..... 96

Hansen, A. E..... 96
Hazard Mfg. Co..... 92
Heil Co., The..... 20
Hersey Manufacturing Co..... 3
Higgins, J. Wallace..... 96
Hill & Ferguson..... 96
Hobbs, L. F..... 88
Hoisting Engine Sales Co..... 86
Holt Manufacturing Co..... 22
Houston, J. C..... 86
Hubbard-Floyd Co., Inc..... 86
Hyland Co., R. H..... 83

Indiana Air Pump Co..... 90
International Motor Co..... 87

Johnson Co., Inc., Geo. A..... 97

Kelker, Gates & De Leuw..... 96
Kelly-Springfield Tire Co..... 88
King Mfg. Co..... 95
Kinney Mfg. Co..... 26
Knickerbocker Co., The..... 18
Koehring Co..... 8
Koppel Indus. Car & Equip. Co. 12
Kuhn, Frank J..... 85

Lane Co., T. J..... 87
Littleford Bros..... 20
Lynchburg Foundry Co..... 81

McClure Green Engr. Co..... 96
McGraw-Hill Co..... 2
McKenna Co., The..... 87
McKiernan-Terry Drill Co..... 10
Menge Pump & Machy. Co..... 84
Mills Contractors Equip. Co.... 87
Mueller Mfg. Co., H..... 92
Municipal Supply Co..... 36

National Hoisting Engine Co.... 18
National Meter Co..... 94
National Steel Fabric Co..... 12
Nat'l Water Main Cleaning Co. 36
Neptune Meter Co..... 79
Newport Culvert Co..... 4
Nixon Co., Robt. R..... 87
Nordberg Manufacturing Co.... 89
Northern Fire Apparatus Co.... 97
Norwood Engineering Co..... 92

Olsen, Olek..... 84
Otterson Auto Eductor Co..... 90
Owen Bucket Co..... 6

Pawling & Harnischfeger Co.... 14
Payne Dean Limited..... 92
Pease Laboratories, Inc..... 96
Pennsylvania Salt Mfg. Co..... 88
Pioneer Asphalt Co..... 22
Pitometer Co..... 90
Pittsburgh-Des Moines Steel Co. 12
Pittsburgh Meter Co..... 94
Pollock, C. D..... 96
Potts, Clyde..... 96
Porter Co., H. K..... 20

Ransome Concrete Machy. Co.. 38
Raymer Equipment Co..... 85
Robinson, Geo. L..... 96
Rochester Can Co..... 91
Rossiter Co., Edgar A..... 97

Simplex Wire & Cable Co..... 94
Smith, Booth-Usher Co..... 82
Smith & Co., C. E..... 97
Smith Mfg. Co., A. P..... 90
Snare Corp., Frederick..... 96
Southern State Machinery Co... 82
Standard Oil Co. of Indiana..... 75
Standard Scale & Supply Co.... 37
Sykes Company..... 87

Terry & Tench Co., The..... 86
Terry Mfg. Co..... 20
Thew Shovel Co..... 30
Thomson Meter Co..... 93
Truscon Steel Co..... 13
Tucker Co., Geo. G..... 83
Turbine Sewer Mch. Co..... 90
Turner Co., C..... 87
Turner, J. D..... 82

Union Metal Mfg. Co..... 95
Union Water Meter Co..... 93
Universal Audit Co..... 97
Urdi Co., G..... 97

Wallace Equipment Co..... 85
Wallace & Tiernan Co., Inc..... 34
Waring-Underwood Co..... 6
Warren Bros. Co..... 31
Weller Mfg. Co..... 30
Western Wood Pipe Pub. Bureau.. 91
Weiss, B. M..... 81
Whayne Supply Co., R. C..... 84
Whinery, S. B..... 87
White Co., The..... 88
White, Gilbert C..... 97
Winther Motors, Inc..... 77

Yancey Bros..... 83

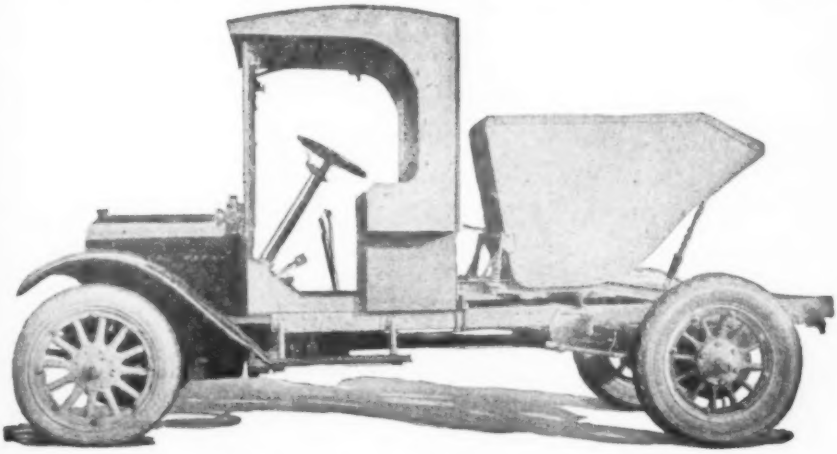
Ziegler & Co., Inc., Wm. H..... 85

Manufacturers who advertise in alternate issues may not appear in the above INDEX, but are carried in bold face type in the WHERE TO PURCHASE section at the front of this magazine. Readers wishing catalogs or further information regarding the products of these manufacturers should write to the CATALOG DEPARTMENT, CONTRACTORS' & ENGINEERS' MONTHLY, TRIBUNE BUILDING, NEW YORK CITY.

C

GMC

General Motors Trucks



GMC Road Builder

The GMC Road Builder is a specially equipped motor truck with capacity of one yard of concrete or other material. Body so arranged that load is well balanced on both axles. The special equipment can be removed easily, leaving a regular chassis on which a standard body can be used—making it an all-year utility. This is chassis standardized by U. S. Army and of which thousands were used overseas. Ask any soldier who was in France how they stand the abuse.

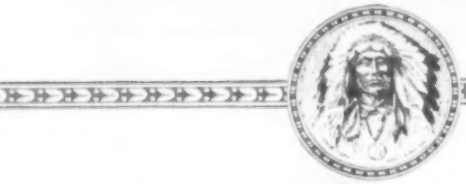
Ask us for special circulars on this Road Builder—
We make trucks in all capacities from ¾ to 5-ton.

GENERAL MOTORS TRUCK CO

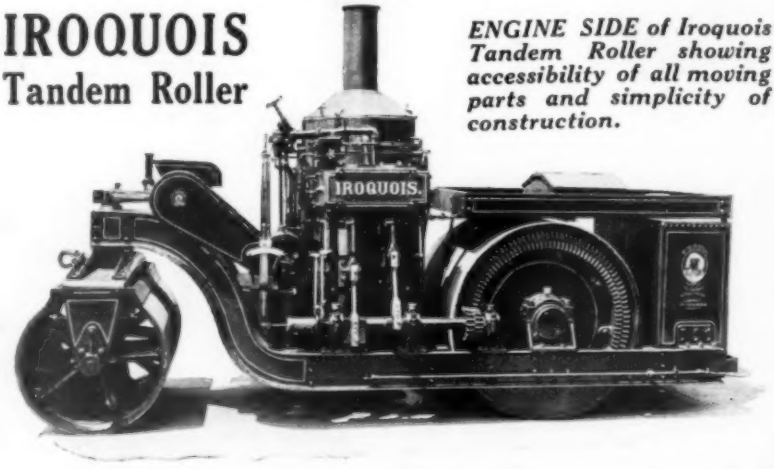
Pontiac, Michigan

Branches and Distributors in principal cities

E JOHN CRERA
OCT 2 5 1921
LIBRARY



IROQUOIS
Tandem Roller



ENGINE SIDE of Iroquois Tandem Roller showing accessibility of all moving parts and simplicity of construction.

Do you need a roller at once?

A telegram will start an Iroquois Tandem Roller enroute to you the same day. You get the best roller made—***in the quickest possible shipping time.*** No delay in beginning or completing a contract.

Iroquois Tandem Rollers, like all equipment of the Iroquois Line, are built *specifically* to give long and dependable service at minimum expense. ***First cost comes last.***

That is why Iroquois Tandem Rollers are being used by most successful contractors throughout the world—why leading municipalities have adopted them as standard equipment.

Iroquois Tandem Rollers are made in three sizes—2½-ton, 5-ton, and 8-ton—to provide the right type of roller for asphalt, brick, creosote blocks, macadam, grade or golf links.

Why be content with an ordinary roller when you can get an IROQUOIS? Detailed specifications and prices of Iroquois Tandem Rollers and other equipment of the Iroquois Line will be sent on request.

Trade Mark
Reg. U. S. Pat. Off

IROQUOIS SALES DEPARTMENT

New York
Chicago
Pittsburgh

THE BARBER ASPHALT PAVING COMPANY
PHILADELPHIA

St. Louis
Kansas City
Atlanta
San Francisco